FARM SCIENCE AND PRACTICE

Bulletin 673 December, 1947
65th Annual Report
OHIO AGRICULTURAL EXPERIMENT STATION
WOOSTER, OHIO

THE HONORABLE CHARLES F. KETTERING
PRESIDENT OF THE BOARD OF CONTROL
OHIO AGRICULTURAL EXPERIMENT STATION

DEAR SIR:

I HAVE THE HONOR TO PRESENT TO THE BOARD OF CONTROL FOR TRANSMISSION TO THE GOVERNOR OF OHIO, AS REQUIRED BY LAW, THE SIXTY-FIFTH ANNUAL REPORT OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDED JUNE 30, 1946.

EDMUND SECREST
Director

THE HONORABLE FRANK J. LAUSCHE
GOVERNOR OF OHIO

DEAR SIR:

I HAVE THE HONOR TO PRESENT TO YOU THE SIXTY-FIFTH ANNUAL REPORT OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDED JUNE 30, 1946.

CHARLES F. KETTERING
President, Board of Control

COVER PICTURE: View at the Station Pasture Research Farm showing luxuriant alfalfa-brome-Ladino pasture in its third year. *See* Pasture Farm article on page 12.

Farm Science and Practice

SIXTY-FIFTH ANNUAL REPORT

For Year Ended June 30, 1946

Agricultural research will be implemented in a substantial manner by the enactment of Public Law 733 by the Congress of the United States, approved August 14, 1946.

The Act provides for grants-in-aid to the state agricultural experiment stations in marketing and production studies, and supplements appropriations to the U. S. Department of Agriculture for similar research. The Act also provides for "research or utilization and associated problems in connection with the development and application of present, new, and extended uses of agricultural commodities and products thereof."

It was the intent of the Congress to emphasize the need for, and support is provided for, more comprehensive study of the agricultural marketing problems of the country.

The Act further provides for closer cooperation between state experiment stations and the bureaus of the Federal government in coordinating research activities and to avoid unnecessary duplication of effort. It was also the intent of the Congress to pattern, so far as possible, the pooling of research facilities of the nation.

Ohio shares in the grants-in-aid, and is cooperating with the 12 North Central states and the U. S. Department of Agriculture. Fourteen projects have been set up in the fields of marketing and production. The Production and Marketing Act is confidently expected to be a milestone in agricultural progress.

Following precedent the sixty-fifth Annual Report is limited to a discussion of some of the more important projects and results obtained during the year.

Edmund Secrest

Director

Topics Discussed

FARM INCOME AND LIVING

DAIRYING

LIVESTOCK

POULTRY

FARM CROPS

SILAGE

SOIL MANAGEMENT

FARM ENGINEERING

FRUITS

VEGETABLES

Farm Income and Living

Changes in Size of Farms in Ohio, 1900-1940

Three rather distinct trends are evident when one compares the size of farms in Ohio in 1940 with that of 1910. First, there has been an increase in the number of rural resident and part-time farms. Second, there has been a pronounced decrease in the number of farms of 20 to 100 acres in size. Third, there has been a steady increase in the percentage of farms over 160 acres in size.

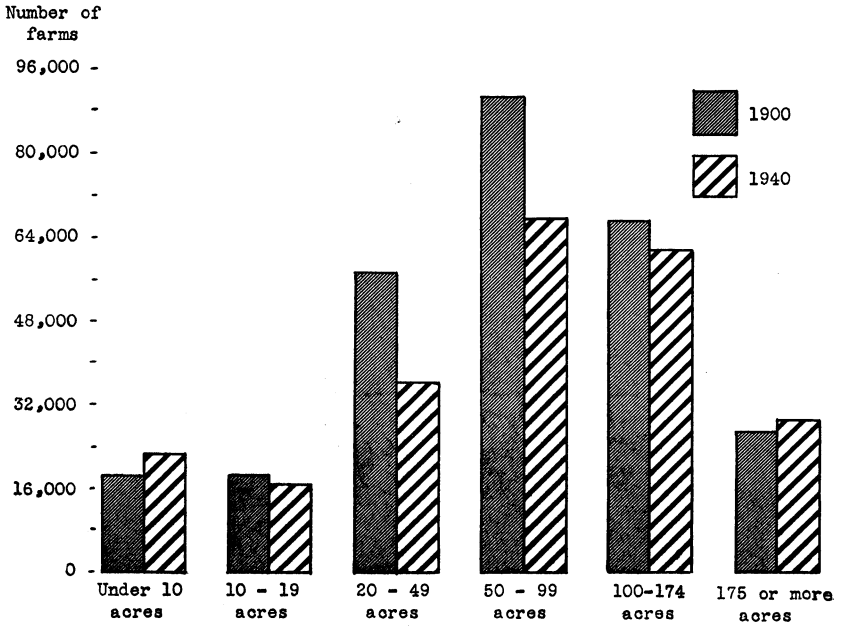


Fig. 1.—Number of farms by size groups, in Ohio, 1900 and 1940

There is little evidence that the family sized farm is decreasing in relative importance in the state. The tendency is rather to increase the acreage of the family sized farm in keeping with the ability of the operator to handle more land.

J. I. Falconer and J. H. Sitterley

Family Farming Arrangements

To the casual observer it would appear natural and practical in many cases for a son to work with his father, taking up the burdens and responsibilities of the farm business as the parents advance toward eventual retirement. As a matter of fact the above process is carried through on thousands of Ohio farms, on other thousands it either never develops because some obstacle stands in the way or, if an arrangement is started, it does not endure.

Believing that we can learn from the successes and failures of families to work out farming arrangements of the father-son type, some 60 farms were visited in 1946 where some such plan was in operation. In nearly 90 percent of the successful cases observed boys have "grown" into a mature arrangement through successive stages. All told, the arrangements were grouped into eight classes which show a progression from top to bottom as listed below. However, it is not to be inferred that all these arrangements would be necessary or practical in any individual case.

TABLE 1.—Arrangements used at start and status in 1946 of 60 successful father-son farms in 15 Ohio counties

Type of arrangement	Number of farms	
	Plan used at start	1946 plan
1. Wages and bonuses to son	9	5
2. Enterprises and income share to son	12	4
3. Quarter-share to son	3	4
4. Third-share to each son	15	16
5. Half-share to son	21	19
6. Equal partnership	—	8*
7. Cash rent by son	—	1
8. Mixed arrangement not classified	—	3
Total	60	60

*Three involved a father and two sons on third-share to each.

H. R. Moore and R. C. Headington

Timber Marketing in Eastern Ohio

Timber marketing in the mixed oak forest area is characterized by clear cutting, lump-sum selling, and portable mill processing into low priced products. All the above circumstances applied definitely to 61 percent of the timber sales and 78 percent of the lumber production observed in this study. The remaining 39 percent of the sales covering 22 percent of the production yielded a better monetary return. Why?

There are many reasons. The following is at least important. In the mixed oak forest area the typical woodland includes trees of several species of variable size, age, growth habits, and vigor. When sold to be clear-cut such a woodland commands a low price because some of the trees may be past their prime and defective, some are too small to yield good quality material, and only part of the trees are at the point of economic maturity. Where selective cutting was practiced to harvest only economically mature trees the average price per unit of material was practically double the average price received under the clear-cut method of harvest.

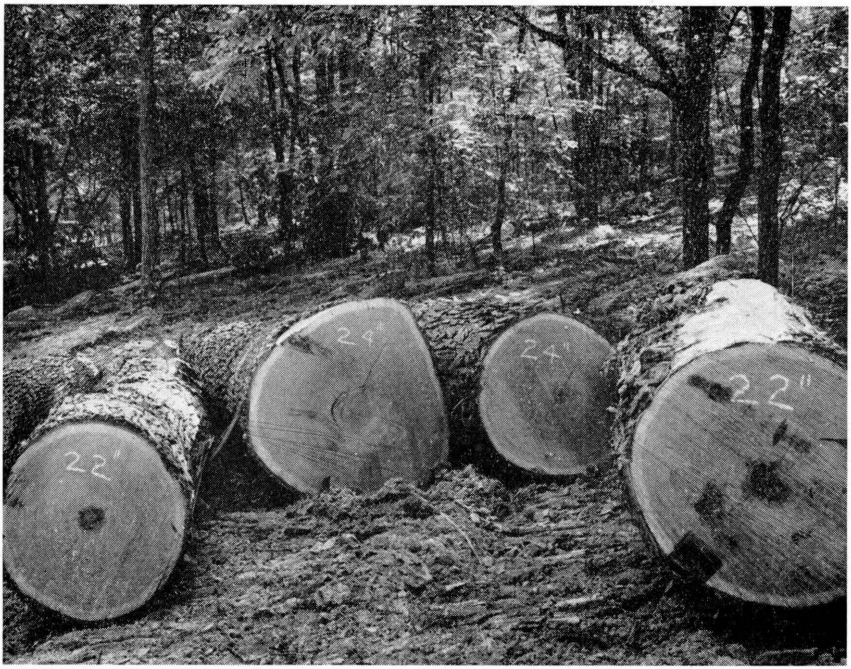


Fig. 2.—An example of selective cutting. Under this method of management the mature saw timber is removed every few years along with crooked, defective, and other less desirable trees.

The study indicates that more emphasis on trucking logs to a central point for milling would accommodate smaller and more frequent harvests from a higher proportion of the woodlands, a practice conducive to more systematic management, particularly in the smaller farm woodlands.

H. R. Moore and O. D. Diller

Market Variations in Hog Prices

Important livestock markets for Ohio are Cleveland, Columbus, Dayton, and Cincinnati. Cleveland averaged slightly higher than other Ohio markets for 200 to 220 pounds good to choice hogs since 1937. Cincinnati was next, followed by Columbus and Cleveland. For the year 1941, for example, Cleveland was 8 cents per hundredweight over Cincinnati while Columbus was 13 cents and Dayton 16 cents under. There was considerable variation from year to year. The Cleveland market was only 1 cent over Cincinnati in 1940 and 1944, but was 14 cents over in 1938. The Columbus market averaged 7 cents under Cincinnati in 1938 but 18 cents under in 1937; while Dayton was 11 cents under in 1940 but 24 cents under in 1943.

Cincinnati and Cleveland are large slaughtering centers in Ohio and also have large consumer populations. This is one of the reasons for higher markets at these centers. Cleveland, too, is located at the edge of the Corn Belt which means longer transportation than at some of the other markets. A study of prices convinces one that our livestock marketing system going into the post-war period must be watched so that prices are kept in line. Weak bargaining, poor transportation, poor conditioning, low quality hogs can and do influence the price at these markets and the differentials between markets. Livestock marketing interests and hog producers must be alert to the weaknesses that may develop.

Geo. F. Henning

Rural Health and Social Adjustment

Early in 1946 the Experiment Station entered into a cooperative agreement with the Division of Mental Hygiene in the Ohio State Department of Public Welfare. Under that agreement a project known as "The Health and Human Development Study" has been carried on in a typical county in western Ohio. Some results pertaining to rural people are now available.

Many farmers were rejected for military service on the basis of their physical examinations. About 400 farm men were registered with the local draft board and 90 percent of them were examined at some time. Of all agricultural workers examined, 36.1 percent were rejected, the rejection rate being about the same for farm operators as for farm laborers. Unfitness was greater among these farm men than among nonfarm workers for whom the rejection rate was only 25.4 per 100 examined.

The incidence of mental and personality disorders was greater among farm men than among other registrants. Of each 100 agricultural workers examined 9 were rejected because of such disorders. The comparable rate for nonfarm men was only 5.9 per 100. It was also found that the incidence of mental and educational deficiency, of heart and vascular defects, of eye defects, and of hernia was greater among registrants from farms.

Based on tests and ratings it was estimated that 13.7 percent of all farm children in the third grade in the schools of the county were poorly adjusted while 8.8 percent showed evidences of superior adjustment. Of those in the sixth grade, 18.7 percent were classified as poorly adjusted and 17.7 percent were classed as exceptionally well adjusted. At both grade levels the incidence of maladjustment was less among farm children than among those from nonfarm homes. But the advantage enjoyed by farm children in this respect was greatest at the younger ages and tended to be lost among older boys and girls.

It was found that rates of juvenile delinquency were much lower among children living in the open country than among those living in city homes. But the rates were lowest of all among children living in villages and some of the larger towns of the county studied.

The evidence indicates that severe mental illnesses are as prevalent in rural areas as in the small towns and cities, but that mentally ill persons are less often hospitalized if they live in the country.

These studies have been largely exploratory. They mark new beginnings in promising research of human development in rural areas.

A. R. Mangus

Dairying

Legume Meadow Mixtures

During the 1946 pasture season an attempt was made to determine the value of supplementary hay feeding to cows grazing legume meadow mixtures. This extra hay was fed for a possible balancing or tonic effect rather than for correcting an inadequacy in the amount of grazing available. Ample grazing was available for the work and at times it even appeared to be in superabundance. In order to keep the pastures fresh, the cows were rotated on the various fields at frequent intervals. The legume meadow mixtures, although varying in composition with the season, consisted of (1) a combination of alfalfa and timothy, (2) two combinations of alfalfa, bromegrass, and Ladino clover, and (3) one of orchard grass, alfalfa, and clover (grazed only once at the close of the season).

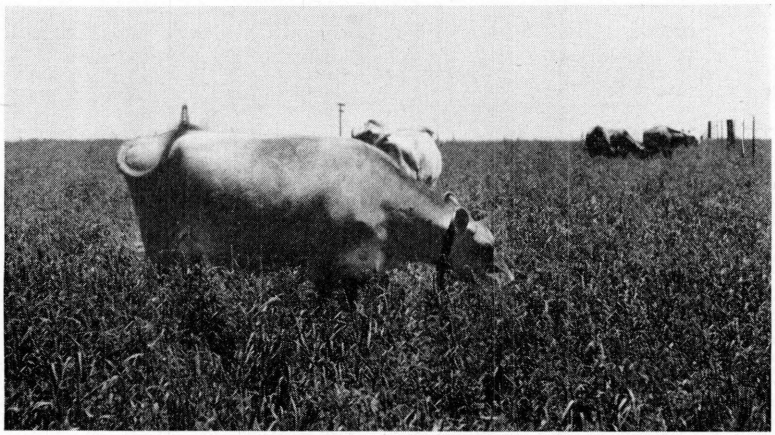


Fig. 3.—Cows grazing on alfalfa-timothy meadow in July. Ample grazing maintains production and saves grain.

The herd of 22 Jersey cows maintained on the Pasture Farm was divided into three groups for the grazing season. One of these groups, consisting of seven of the better producing and more persistent cows, obtained their entire living—with the exception of

1 pound of grain per day for each cow—from the legume meadow mixtures. It was only for the purpose of enticing these cows into their stalls for milking that any grain was fed.

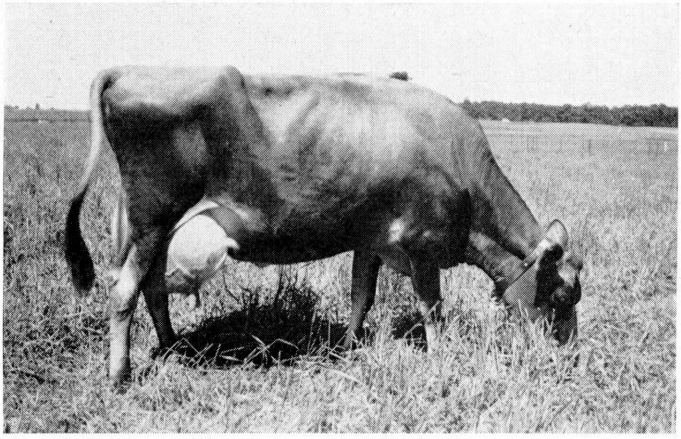


Fig. 4.—Cow 645 grazing alfalfa-timothy meadow. She averaged 54.7 pounds of butterfat monthly for the 4 months she grazed the legume-meadow mixture, while receiving 1 pound of grain daily.

The other two groups of 7 and 8 cows each were alternated between the permanent improved bluegrass pastures and the legume meadow mixtures. When shifted to the legume meadow mixtures, one of these groups received extra hay in the barn, while the other group did not receive hay. On the succeeding shift, the hay feeding was reversed. There were four such shifts made during the season. All these cows received a light allowance of a 50-50 grain mixture of corn and oats with steamed bonemeal and salt added. In the intermediate periods when the cows were on the improved bluegrass pastures, supplementary hay was fed. Timothy was fed during the first legume grazing period while a first-cutting alfalfa-timothy-clover hay was used for the later shifts.

The seven cows kept continuously on the legume-mixed meadows for 119 days, and which received only 1 pound of grain per day, gave no indication of suffering any ill effects from this treatment. With the exception of indicating a desire for hay by their attempts to steal, these cows appeared normal. They gained a little in live weight and none of them scoured severely. The

group averaged 961.3 pounds of 4 percent milk per month for the 4-month period, with the four highest producers averaging 1,122.8 pounds. The ratio of grain consumption to milk produced was 1 to 34 for the group and 1 to 39 for the four heaviest producers.

The experience gained from the other two groups agrees with that obtained with the first group. The production of four percent milk was not markedly increased by feeding the extra hay, nor were the live weight gains consistently affected by feeding the hay.

A comparison can be made in this work between the productions of the cows while on the legume meadows and on the improved bluegrass pastures. Such a comparison shows that productions were approximately equal when the bluegrass was supplemented with hay. This confirms the results obtained on this farm in previous years.

In presenting this work for the 1946 grazing season, it should be remembered that this season was favorable to growth of non-legumes, especially timothy, and that the bluegrass pastures contained a large amount of white clover. It has been our observation that cows practice "mixed" grazing and that the non-legumes in a mixture are greatly appreciated by the cows. This year's experience indicates the milk producing and grain saving possibilities of legume-mixed meadows. Although no marked benefit appeared to be obtained from the supplementary feeding of hay, certainly no unfavorable results were encountered by this practice. Therefore, this report should not be interpreted to mean that the feeding of extra hay in the barn during the grazing season may never be of value.

C. F. Monroe

White Grubs Damage Pastures

The May beetle flight during the summer of 1945 and the white grub population during the fall of the same year were the lowest observed in the Wooster area in 13 years of investigation.

It seems likely that the dry period that prevailed through July in both 1944 and 1945 was responsible for killing large numbers of newly hatched grubs. This statement applies particularly to the annual white grub, *Cyclocephala borealis*, the eggs of which normally hatch in July. Because of the July drouth, it is believed that it was difficult for the young grubs to become established. But little damage from this species was observed during either of the 2 years.

Phyllophaga grubs, although rare in 1945, caused considerable damage to bluegrass pastures and to corn in the vicinity of the Experiment Station in 1944 when the C brood was in its most active feeding stage. This brood continues to be the most abundant and most destructive of the three *Phyllophaga* broods in Ohio.

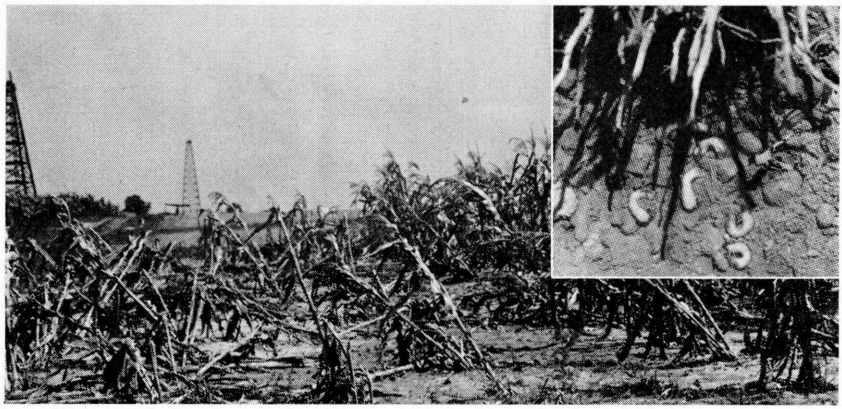


Fig. 5.—White grubs damage bluegrass pastures and corn. The inset picture shows the grubs under a lodged hill of corn.

On the pasture experiment farm at Wooster, the permanent bluegrass pastures continued to carry the highest grub populations. None of the rotated pastures experienced any significant grub injury. In an untreated permanent bluegrass pasture, the grub population in 1944 was 133,000 grubs per acre. In a portion of the same pasture that in 1941 had been disked, treated with 875 pounds of 0-14-6 fertilizer, and seeded to a mixture of alfalfa, orchard grass, and Ladino clover, the grub population in 1944 was only 35,000 grubs per acre.

C. R. Neiswander

Raising Heifers with and without Grain

Holstein and Jersey heifers were raised from 8 months of age to first freshening without grain, except that which they received in corn silage. Along with these heifers, another group was raised under the same conditions with the usual allowance of grain. All 53 animals were fed liberally on a mixed alfalfa-timothy hay, often of not too good a quality. Corn silage was also fed in moderate amounts. During the grazing season, the heifers were kept on pasture, which was supplemented with hay feeding when the pastures were short. In order to prevent any possible phosphorus deficiency, steamed bonemeal was fed to the no-grain group.

Following freshening all the heifers received uniform treatment, were given the same grain mixture, and were fed liberally for a near-maximum production. During the first lactation, all the heifers were maintained under barn feeding conditions in order to avoid any irregularities that could have arisen from varying pasture conditions.

At the average freshening age of 2 years and 5 months, those animals that had received grain previously were heavier, higher at the withers, and had a larger chest circumference than those which had not received grain previously. This was true for both the Holsteins and Jerseys, but more pronounced with the former breed. Likewise, the condition and appearance of the grain-fed heifers was better than that of the no-grain group. The milk and butterfat production was also higher during the first lactation in the groups that had been raised on grain than those which had received no grain.

The results of this trial indicate the advisability of getting good growth and development in heifers previous to freshening. In order to accomplish this purpose, with the roughages commonly available, some grain should be fed.

C. F. Monroe

Birth Weights of Calves Indicate Later Growth

This study was undertaken to determine if the rate of prenatal growth was correlated to later development. If there is a definite correlation, it might serve as a basis for selecting early for size, or for discarding small animals.

The weights at birth of 147 Holstein and 141 Jersey calves were compiled along with monthly weights, taken later in life. The weights of Holstein calves were divided into the four following groups; (1) those which weighed at birth 80 pounds or less, (2) those which weighed 81 to 90 pounds, (3) those which weighed 91 to 100 pounds, and (4) those which weighed above 100 pounds.

The weights of the three lower groups continued in the same order as the birth weights but the fourth group ran about even with the third group.

The weights of Jersey calves were divided into three groups; (1) those weighing 50 pounds or less, (2) those weighing 51 to 59 pounds, and (3) those weighing above 59 pounds. The weights in these three groups remained in the order of the birth weights. The differences in weights increased as the animals grew older.

The sires used may have influenced the results in that the daughters from the various sires were not equally distributed among the groups.

There were many individual exceptions to this trend but there seems to be a definite tendency for the weights of cows to remain in the order of their birth weights and for the initial differences to increase. These limited data indicate a relation between prenatal growth and later development. Some of the exceptions may be due to influences other than heredity.

C. C. Hayden

Weight Changes in Dairy Cows

Dairy cows which are properly fed and cared for gain in weight from conception to parturition. At parturition there is a large loss of weight and a slow loss may continue for some time, if milk production is heavy. This study was made to determine the extent of the changes in weight and their significance.

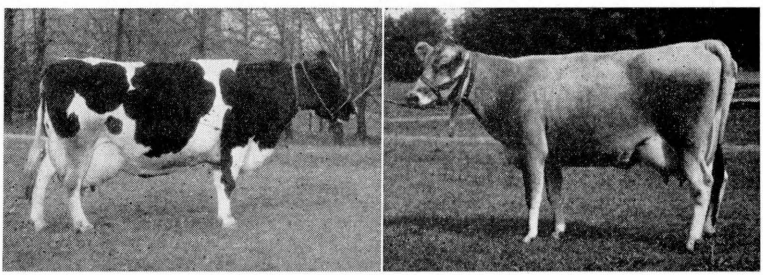


Fig. 6.—These cows are in good condition for calving—not too fat, not too thin.

The weights from 100 Holstein and 100 Jersey cows were used. The weights were recorded monthly from conception until 6 months after parturition. Weights from cows with two or more gestations were used, all ages being included. There were 437 records from Holsteins and 426 from Jerseys.

During pregnancy, the average gain by the Holsteins was 250 and by the Jerseys 164 pounds. At parturition, the loss by Holsteins was 190 pounds and by the Jerseys 102 pounds. The loss by the Holsteins was almost exactly twice the average birth weight of 512 Holstein calves born in the same herd. The average loss by the Jerseys was about 10 pounds less than twice the birth weight of 208 Jersey calves born in the same herd.

The Holsteins, on the average, did not decrease in weight as expected after parturition. Probably this was due to the fact that a large percentage of them were growing animals. The Jerseys continued to lose weight for about 45 days after parturition.

These changes indicate increased demands on the body and that proper feeding and care through this period are important.

C. C. Hayden

Vitamin D of Doubtful Value in Preventing Milk Fever

In past years, controlled experiments have been in progress in which the experimental groups of cows were fed respectively 1 million and 2 million units of vitamin D daily in the form of irradiated dry yeast for 30 days prior to parturition and for 7 days thereafter. A study was made of the blood calcium, phosphorus, and magnesium and of the incidence of milk fever in both the control and experimental group. This year 5 million units of vitamin D were fed daily as irradiated ergosterol in oil for 14 days prior to parturition and for 3 days thereafter.

The results may be stated briefly as follows:

1) There was no decrease in the incidence of milk fever at any of the levels of vitamin D fed.

2) Increases were obtained in serum calcium and phosphorus before parturition at the 2 and 5 million unit levels of feeding, but these were nullified within 12 hours after parturition in both normal cows and cows that develped milk fever. Therefore, no lowering of milk fever incidence could be expected due to the pre-freshening serum calcium increases. The blood studies are considered as supporting evidence of the incidence results.

Vitamin D assays of the blood of cows fed the various amounts of vitamin D as compared to the controls showed that the blood of cows receiving 1 million units had twice the vitamin D level of the control cows, those receiving 2 million units four times, and those receiving 5 million units ten times the normal level.

It is concluded that the incidence of milk fever cannot be controlled effectively by the feeding of massive doses of vitamin D for from 2 to 4 weeks prior to freshening.

J. W. Hibbs and W. E. Krauss

Thyroprotein for Dairy Cows

Prompted by the widespread interest in the possibility of using Thyroprotein ("Protamone") in dairy cattle rations as a means of stimulating milk production, an experiment was conducted to study not only its effect on milk and butterfat production, but also on some of the constituents of blood and milk.

"Protamone" was fed to Jersey cows at the rate of 1 gram per 53 pounds of body weight (approximately 15 grams) daily for two controlled 6-week periods. In the first period, the grain feeding was adjusted according to the level of milk production and in the second, the grain was limited, based on the level of feeding at the beginning of the period. This experiment resulted in the following observations:

1) An average increase in milk production, which was dependent upon the nutrient intake of the cow. This increase was followed by a rapid decline to a subnormal level after termination of "Protamone" feeding.

2) A decrease in body weight and increases in pulse and respiratory rates.

3) No changes in milk or blood plasma carotene or ascorbic acid. A few individual cows showed decreases in milk and blood plasma vitamin A. Although suggestive, these results were not conclusive.

4) A decrease in milk thiamin during "Protamone" feeding and an increase to higher than normal levels following the termination of "Protamone" feeding.

5) Lowering of milk riboflavin during the experimental period, the most marked effect being observed during the period in which the nutrient intake was limited.

6) No marked effect on total milk protein.

7) No significant elevation in basal metabolic rate of rats fed exclusively on milk from "Protamone" fed cows.

In view of these results it would seem that until more is known of its physiological effect on the cow, great care should be exercised in feeding "Protamone" to dairy cows. The greatest possibility for its use in dairy cattle feeding may lie in the treatment of hypothyroid individuals rather than in general feeding to all milking cows in the herd.

J. W. Hibbs and W. E. Krauss

Amino Acids Aid Semen Storage

Supplementing the control diluent of buffered-egg yolk with an amino acid or a mixture of amino acids (dl-a-alanine, b-alanine, l-arginine, glycine, l (+) leucine, l (+) lysine, al-methionine, and l proline) maintained 9 to 31 percent more living cells after 12 days in storage than when a gelatin buffered-egg yolk was used. All cells processed in the control diluent of buffered-egg yolk died within the 12-day storage period.

Adding both an amino acid, like dl-a-alanine, and nucleic acid to the control diluent appeared to have no advantage in prolonging sperm life as compared with one supplemented with a single amino acid.

Phenylalanine and bovine plasma were found to be toxic while cystine, tyrosine, and casein hydrolysate were insoluble and could not be used.

Incorporation of amino acids in a media for the storage of spermatozoa may also result in a bacteriostatic effect. It was found that the addition of either b-alanine, arginine, leucine, lysine, or proline to a diluent tended to retard the growth of bacteria in refrigerated semen during a 7-day storage period.

Dl-a-alanine and methionine caused a decrease in bacteria counts for the same period while glycine caused the count to decline throughout a storage period of 14 days. On the other hand, bacteria increased rapidly in the buffered-egg yolk and the gelatin buffered-egg yolk diluted samples.

C. E. Knoop and W. E. Krauss

Potassium Iodide and Skimmilk Powder Improves Spermotogenesis

Eleven sires showing symptoms of becoming sterile received 50 milligrams of potassium iodide and 0.8 pound skimmilk powder daily as a supplement to their normal ration of hay and concentrates. The control periods averaged 145 days (range, 24 to 227 days) and the experimental periods averaged 134 days (range, 67 to 220 days).

Seven bulls responded favorably to this oral treatment. Semen collection data for the control and experimental periods are summarized in table 2. The figures for motility-activity of the processed spermatozoa in storage include data from only four bulls.

TABLE 2.—Influence of feeding potassium iodide and skimmilk powder on spermatogenesis

	Vol. cc.	Density per c/mm (× 1000)	Output per collection (× Mil.)	Motility-Activity			
				2 days	4 days	6 days	Drop after 6 days
Control period	5.6	993	4,747	78:48	71:41	59:32	19:16
Experimental period	6.4	1,152	6,130	81:50	76:46	72:42	9:08
Increase, percent	14	16	29	.....	.....	.....	.....

Conception rates for several bulls also improved during and following the experimental feeding periods.

Because of these favorable results, biological and chemical work will be necessary to determine what physiological processes are involved.

C. E. Knoop and W. E. Krauss

Vitamin Supplements Will Not Prevent Calf Scours

In order to obtain some detailed data on the effect of feeding vitamin A in large amounts on the blood vitamin A level of calves, the following plan was devised, using 35 calves in the Experiment Station herd. Group I (10 calves) served as controls. Group II (13 calves) received 250,000 units of vitamin A on the third and tenth days after birth. Group III (12 calves) also received 250,000 units of vitamin A on the third and tenth days and, in addition, 50 milligrams of niacin were fed daily for the first 20 days.

Plasma vitamin A, carotene, and ascorbic acid determinations were made on the third, tenth, and twentieth day in all calves, and also on the thirtieth day in the females. The male calves in each group were slaughtered on the twenty-first day after birth and the total vitamin A liver storage was determined. The blood level of vitamin A and the vitamin A liver storage were found to be increased in the calves fed the supplementary vitamins but no benefit to the health of the calves was noted, as judged by scour incidence and general appearance. No beneficial effect of feeding niacin in addition to vitamin A was observed in this experiment.

In order to try the effect of feeding large single doses of vitamin A in the control of calf scours on a large scale in different herds, an experiment was set up in which eight of the Ohio Department of Public Welfare herds cooperated.

On the third day after birth, alternate calves born in these herds were fed either a red blank capsule or a yellow loaded capsule containing 250,000 units of vitamin A.

No marked effect on the health of the calves was noted which could be attributed to the vitamin A supplement as judged by the incidence, duration, or severity of scours. The scour incidence data are shown below.

	No. of calves	No. of scours cases
Control group	263	72
Experimental group	268	64

Of the 263 calves fed the blank capsules, 27.4 percent had scours for an average of 4.3 days. Of the 268 calves fed the vitamin A capsules, 23.9 percent had scours for an average of 4.2 days.

It is concluded that large doses of vitamin A early in life are of doubtful value to the well-being of the calf provided the calf gets sufficient colostrum. In conditions under which the colostrum is limited or of poor quality, where the calves are suffering from scours, or where poor quality hay feeding is anticipated following whole milk feeding, extra vitamin A probably would be of benefit to the health of dairy calves.

J. W. Hibbs and W. E. Krauss

Vitamin Content of Colostrum

Carotene, vitamin A, and riboflavin content are being determined on colostrum obtained at each of the first 10 milkings following parturition and at the twentieth milking. From the data shown below it is apparent that the concentration of these vitamins is extremely high in the first milking and that values approaching those of normal milk are not reached until after the seventh milking.

Milking number	Carotene*	Vitamin A*	Riboflavin*
1	290	212	6.4
2	189	180	3.6
3	115	94	2.3
4	89	80	2.0
5	74	89	2.0
6	52	58	1.8
7	38	48	1.7
8	31	49	1.8
9	30	42	1.6
10	29	44	1.7
20	38	46	1.7

*Carotene and vitamin A in micrograms per 100 ml. and riboflavin as milligrams per liter.

T. S. Sutton and H. E. Kaeser

Livestock

Birdsfoot Trefoil Makes Good Sheep Pasture

A 3-year-old mixture consisting of a good stand of birdsfoot trefoil together with a light mixture of meadow fescue and timothy was grazed with yearling ewes between May 8 and August 23, and furnished 2,591 continuous sheep pasture days on the 3-acre paddock, or about 8 ewes per acre for 107 days. During this time the test ewes on the birdsfoot trefoil pasture gained an average of 7.1 pounds per ewe, while a comparable lot grazing a mixed clover-grass meadow type pasture gained an average of 6.2 pounds per ewe.

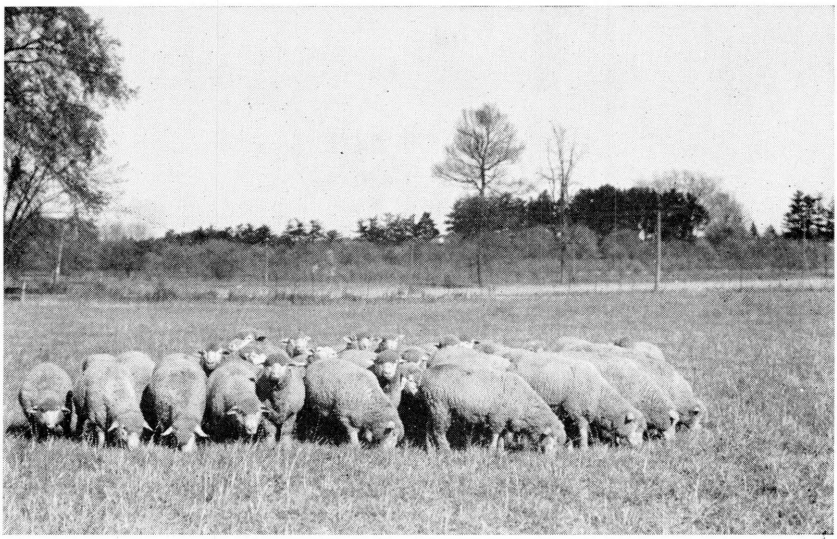


Fig. 7.—Columbia ewes grazing on birdsfoot trefoil mixture. Note the coarse stems refused by the sheep.

These weight differences are not large enough to be significant; however, they do show that the birdsfoot trefoil pasture was fully equal to the mixed clover-grass meadow pasture. The average weight of the ewes at the close of the test was 97 pounds.

After the conclusion of this test period, 44 head of sheep had access to both the birdsfoot trefoil paddock and the mixed clover-grass paddock until October 20. The sheep were observed to graze

for a few hours on the birdsfoot trefoil and then move into the clover-grass paddock for the rest of the day. The birdsfoot trefoil continued to make good growth through October and later went into the winter with a good top cover.

Observations of the grazing habit of the ewes in 1946 confirmed our previous observation that if the birdsfoot trefoil stems were permitted to grow long and to approach maturity, the sheep had difficulty in snapping off the bite with a short jerk of the head and so were discarded for shorter stems. It may be that the more mature stems, especially if in bloom, were not as palatable as the less mature stems. The maximum utilization of the birdsfoot trefoil was obtained from rather close grazing, or by an occasional clipping, if the growth got too long.

The grasses (timothy and meadow fescue), which made up less than one-third of the mixture, appeared to be somewhat more closely cropped than the birdsfoot trefoil, indicating that these grasses are most palatable to sheep. The birdsfoot trefoil, however, seemed to have played the important role of a good legume in the mixed pasture.

L. E. Thatcher and D. S. Bell

Corn Cobs in the Lamb's Ration

One double-deck carload of western lambs was fed during each of three winter seasons to ascertain whether lambs would manifest the same ability to handle and make efficient use of corn cobs in ground ear corn as shown by fattening cattle.

The results show that lambs do not have the same ability as steers to utilize the cob part of the corn plant. Heavy lambs averaging 75 to 80 pounds in weight at the start are slightly more efficient in their ability to utilize the cob than are lighter weight lambs, averaging 62 to 65 pounds in weight at the start.

Lambs do not handle double the amount of cob in ground ear corn to advantage and this, in a sense, is a double check on the point that lambs and steers apparently differ in their ability to utilize cobs, even though both are ruminants.

The results were such it can be stated that if a farmer has a grinding mill and wishes to grind ear corn for lambs, the lambs will utilize the feed in this form but will take a week or so longer to make the same gain in weight as results from feeding shelled corn.

D. S. Bell

Protein Feeds Aid Roughage Digestion

Roughages constitute one of the major items in beef cattle feeding. The efficiency with which hays, silages, and the cob fraction of corn-and-cob meal are used is important in the over-all cost of beef production. Digestion experiments with steers indicate that the concentrate portion of the ration fed influences the utilization of the roughage consumed.

Of particular interest is the finding that in heavy corn rations for cattle both corn cobs and timothy hay are digested more efficiently when liberal amounts of soybean oil meal are fed. This finding has been extended by making use of semi-synthetic rations for steers in digestion trials in attempts to discover what characteristics in soybean oil meal or other protein concentrates are responsible in bringing about good roughage utilization.

The data obtained thus far is incomplete; however, progress indicates that there are factors of practical importance in certain protein concentrates other than the protein furnished as such.

Wise Burroughs and Paul Gerlaugh

Crystal Violet Vaccine for Prevention of Hog Cholera

A limited number of pigs were used in tests of four commercially prepared vaccines to determine their efficiency as protective treatments. The pigs were subject to hog cholera virus injection at different periods ranging from 27 to 153 days after vaccine treatment.

Several pigs, irrespective of the particular vaccine used, showed evident reaction when their immunity was tested. A survival of all treated pigs was obtained with the use of one vaccine only.

No undesirable reactions occurred in any of the vaccine-treated pigs prior to their experimental hog cholera exposure. Deaths occurred in tests at the twenty-seventh and seventy-fifth day following vaccination but none in tests on the one hundred and second and the one hundred and fifty-third days.

The results of these tests are in close agreement with those obtained in the use of several lots of crystal violet vaccine prepared at this Station.

The field for utilization of this vaccine is somewhat limited since it is contra-indicated where hog cholera infection is present owing to the period of time (2-3 weeks) required for immunity to develop following administration of the vaccine.

B. H. Edgington and Norma Frank

Soybean Oil Meal for Pigs in Dry Lot

Further studies on the possibilities of improving a ration of yellow corn, soybean oil meal, ground alfalfa, and minerals for growing and fattening pigs in dry lot were carried on.

Ground Oats, included at the same rate as the soybean oil meal, resulted in no greater gains per unit of feed but in sufficiently faster gains to enable the pigs to be marketed 13 days earlier than those without them.

Condensed Fish Solubles added at the rate of 1 pound to 8 of soybean oil meal, stepped up the rapidity of the gains 15.6 percent but reduced the feed required per unit of gain only 0.7 percent.

In a different test in which condensed fish solubles was fed at the rate of 1 pound to 5 of soybean oil meal and in which dry rendered tankage and fish meal were fed at the same rate as the soybean oil meal, the three were approximately equally effective in improving the ration.

Synthetic Methionine, fed at the rate of 0.2 percent of the total ration, was of no benefit.

Soybean Flour was tried as a substitute for soybean oil meal in one test. Soybean flour is free from the hull or outer coat of the bean and is made at a relatively low temperature. Soybean meal contains the hull. That used was made at a relatively high temperature. Like raw soybeans and low-temperature meals, soybean flour gave poor results. After 12 weeks, half the group was switched to grits, which is similar to the flour except that it consists of particles about the size of wheat kernels, and half was switched to flour from the original supply which was moistened, cooked an hour with steam under pressure, then dried and ground. After it was cooked, the flour gave good results. It produced considerably faster and more efficient gains than the grits.

Dried Distillers' Solubles, used at the rate of 1 pound to each 4 of the supplemental mixture, or approximately 6 percent of the total feed, reduced the feed required per unit of gain 2.9 percent and increased the rapidity of the gains sufficiently to enable the pigs to be marketed 21 days earlier than those without the solubles.

Dried Brewers' Yeast, at the rate of 2 percent of the total feed, increased the rapidity of the gains 13 percent and lowered the feed required per unit of gain 4.7 percent. Because of its relatively high price, feeding the brewers' yeast with yellow corn, soybean oil meal, ground alfalfa, and minerals to pigs in dry lot did not pay.

Growing Yeast in the wet feed for 24 hours again proved beneficial. Although they were fed twice daily, whereas the others were self-fed, the pigs on the wet feed containing the growing yeast remained healthier and made faster and greater gains per unit of feed consumed than those on the dry feed containing no yeast.

Fish Meal or Dry Rendered Tankage, as mentioned, was effective in improving yellow corn, soybean oil meal, ground alfalfa, and minerals for dry lot feeding.

W. L. Robison

Amount of Protein for Full-fed Pigs on Pasture

In an experiment in 1944 on rape pasture, five groups of 20 pigs each, which were carried from approximately 50 to 215 pounds in weight, were fed corn, minerals, and a protein concentrate of tankage and soybean oil meal in a 1 to 2 ratio, according to the following plan:

TABLE 3.—Plan for feeding pigs on pasture

Lot	Protein allowance		Percent protein concentrate in ration		Percent total protein in ration	
	To 120 pound weight	From 120 pound weight	To 120 pound weight	From 120 pound weight	To 120 pound weight	From 120 pound weight
1	Full	Full	16.8	10.2	14.6	12.0
2	Full	Reduced	16.8	5.4	14.6	10.1
3	Reduced	Reduced	10.2	5.4	12.0	10.1
4	Full	None	16.8	0.0	14.6	7.9
5	Reduced	None	10.2	0.0	12.0	7.9

In 1945, three groups of 20 pigs each, which were on a grass mixture of spring-sown winter wheat and Peruvian alfalfa, were fed the same as lots 1, 3, and 5 the preceding year. A fourth group was self-fed ground corn and a mixture of the protein concentrate and minerals separately. A fifth was given a full feed of corn, plus a combination of the protein concentrate (0.27 pound) and minerals, 0.03 pound per head, twice daily.

When the carbonaceous feed and the protein concentrate were both palatable, self-fed pigs balanced their own ration satisfactorily.

When the pigs were fed twice daily, as is done when ear corn is used, a satisfactory method of apportioning the protein concentrate was to feed a given quantity daily a head, in two feeds.

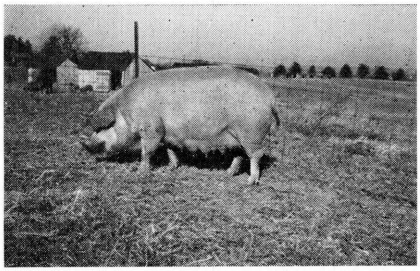


Fig. 8.—View of Station hog pastures.

Reducing the protein allowance resulted in increasing the amount of pasture consumed.

Pigs on pasture, fed a normal amount of protein concentrate for the entire time, were ready for market 7 days earlier than pigs fed a normal amount of protein concentrate during the growing but no protein concentrate during the fattening period. They required slightly less feed per unit of gain but, since they were given a total of a little over twice as much of the relatively costly high-protein feed, made no more economical gains. The latter plan resulted in more efficient and more economical gains and was a more satisfactory method of conserving a limited protein supply than was one of feeding a reduced amount of protein concentrate for the entire time. Both required approximately the same total amounts of high-protein feed.

W. L. Robison

Dry, Soaked, and Yeast-Fermented Feed for Pigs

In a dry lot experiment, in which a ration of ground yellow corn, soybean oil meal, ground alfalfa, and minerals was used, self-fed pigs ate 21 percent more feed daily a head, made more rapid gains and were ready for market 17 days earlier but required 8.2 percent more feed per unit of gain than pigs full-fed the same ration, dry, twice daily.

Of two groups which were fed twice daily, those whose feed was soaked for 24 hours ate 11.5 percent more feed, made 16.7 percent faster gains, were ready for market 23 days earlier, and required 4.7 percent less feed per unit of gain than those whose feed was dry. Those on the soaked feed took less daily a head but gained more rapidly, were ready for market 6 days earlier and required 11.9 percent less feed per unit of gain than the self-fed group. Since the experiment was carried on during the summer, some fermentation of their feed occurred.

A group on soaked feed in which yeast was grown, ate little more feed but gained faster, were ready for market 5 days earlier, and required 3.3 percent less feed per unit of gain than the group

on feed that was merely soaked. The former were ready for market 11 days earlier and required 14.8 percent less feed per unit of gain than the self-fed group.

W. L. Robison

Crossing Inbred Lines of Swine of Different Breeds

Experiments in which purebred and crossbred pigs are being compared have been carried on at the Miami County Experiment Farm since 1936. The purebreds are Durocs. To produce the crossbreds, a rotation system of crossing is followed. Sires of the Poland China, Hampshire, and Duroc breeds are rotated on successive generations of sows selected from the herd. The original sows were Durocs. After the start, the sows themselves are of mixed breeding. Fall gilts are used. They farrow their first and second litters when approximately 1 year and 1½ years of age, respectively. After their second litters are weaned the sows are sold. Thus a new generation is produced each year. At the beginning of the third cycle the pigs out of the sows of mixed breeding were compared with both purebred and first-cross pigs.

A repetition of the project with a third group added was started in 1944. The second and third groups are both produced by rotating sires of the Poland China, Hampshire, and Duroc breeds on successive generations of sows selected from the herd. They differ in that the second is by non-inbred whereas the third is by inbred sires. Likewise, the original dams of the second and third groups were non-inbreds and inbreds, respectively. The table below briefly gives the results secured from the two crops of first generation pigs.

TABLE 4.—Crossing inbred lines of swine of different breeds

	Purebred Durocs	Poland China × Durocs	Inbred Poland China × Inbred Durocs
Number of litters	6	6	4
Live pigs per litter at birth	9.7	8.0	8.7
Pigs per litter at 180 days	6.8	6.8	6.5
Average daily gain to 180 days	1.06	1.16	1.19
Weight per litter at 180 days	1309.0	1431.2	1393.3

W. L. Robison, M. A. Bachtell, and P. A. Jones

Crossing Inbred Lines of Swine Within a Breed

In a study, which is still in progress, of crossing inbred lines within a breed of swine, 69 litters were produced in 1944 and 1945. The types of matings made, the distribution of the litters, and the results secured during the 2-year period are shown in table 5.

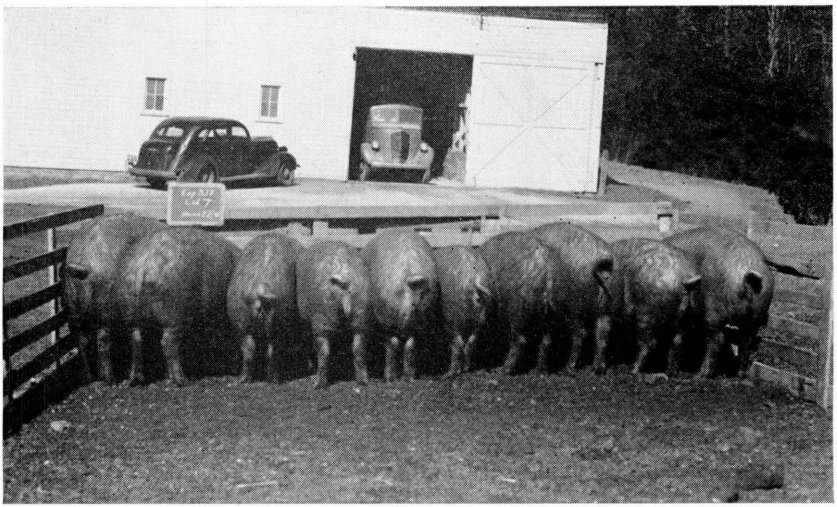


Fig. 9.—Purebred Duroc litter by inbred sire and out of dam produced by crossing two other inbred lines.

TABLE 5.—Crossing inbred lines of swine within a breed

	1 Inbred line by same inbred line	2 Inbred line by different inbred line	3 Inbred line by non-inbreds	4 Inbred line by cross of two or more inbred lines	5 Non-inbreds by non-inbreds
Number of litters	4	14	16	20	15
Live pigs per litter at birth	7.0	7.7	9.3	9.8	9.4
Pigs per litter at 180 days	3.7	6.4	7.4	8.2	7.7
Average daily gain to 180 days	0.87	1.24	1.08	1.16	1.07
Weight per litter at 180 days	588.8	1424.5	1452.1	1718.5	1472.2
Feed per 100 lb. gain	375.1	379.6	368.2	359.0	372.7

W. L. Robison

Poultry

Corn-and-Cob Meal for Chickens

Corn-and-cob meal offers two possibilities of interest to poultrymen—its economy as a feed and use as a fibrous feedstuff for improvement of plumage condition and as an aid in the prevention or control of feather picking and cannibalism.

Three experiments were conducted with the feeding of seven groups, each of 200 Rhode Island Red and Leghorn chicks, during the first 8 to 10 weeks and a like number of experiments were conducted with the growth of chickens from 8 to 26 weeks in which ground shelled corn was substituted by corn-and-cob meal in amounts varying from 27 to 63 percent of the total feed intake.

During the first 8 or 10 weeks, the corn-and-cob meal rations yielded a slightly lower rate of growth than did the ground shelled corn rations. Contrary to this, the corn-and-cob meal rations yielded a higher rate of growth after the first 8 to 10 weeks.

In five experiments conducted with Rhode Island Red and Leghorn pullet layers, the groups that received the corn-and-cob meal rations averaged 7 less eggs per bird and averaged .15 pounds less per bird than the groups that received the ground shelled corn ration. The rate of mortality of all of the groups was much the same. While the egg production and body weight of the layers receiving the corn-and-cob meal rations were slightly less, the condition of plumage and freedom from feather picking was in favor of the corn-and-cob meal rations, despite the fact that all groups received 20 percent of their feed as whole oats.

Since shelled corn is often a contributing cause of the vices of feather picking and cannibalism, maybe the substitution of corn-and-cob meal will serve to correct that unfortunate tendency of shelled corn. The liberal feeding of whole oats is a recognized means of prevention or control of feather picking and cannibalism. Should corn-and-cob meal prove an effective substitute for oats to that effect, it would generally be more economical to use. For detailed results refer to the July-August, 1946, *Bimonthly Bulletin*, No. 241.

D. C. Kennard and V. D. Chamberlin

Animal Proteins Contain Factor for Hatchability and Growth

Previous work has shown that rations complete in minerals and the common vitamins in which soybean oil meal serves as the only source of supplemental protein, is deficient in a factor (or factors) present in certain animal and marine products which is essential for good hatchability of chicken eggs and optimum growth and feed utilization in chicks.

Further work on hatchability has shown that the factor is present in certain extracts prepared from fresh liver and in condensed fish solubles (50 percent solids), as well as in meat scraps and fish meal. It was found that the factor essential for good hatchability was not choline or methionine, or a combination of the two.

Work with chicks showed that choline chloride additions were beneficial if the ration did not contain cereal by-products (wheat bran and wheat middlings). Additions of 0.1 to 0.2 percent methionine to the soybean oil meal rations increased growth and improved feed utilization regardless of whether cereal by-products were included in the ration.

The use of 2 or 3 percent of sardine fish meal or condensed fish solubles in the soybean oil meal rations gave the greatest response in growth and feed utilization. Additions of dried liver, liver extract, dried yeast, or dried milk products to the basal ration gave results intermediate between the unsupplemented and fish-products-supplemented rations.

Evidence was also obtained that the unknown growth factor was not pyridoxine, pantothenic acid, niacin, or folic acid. Preliminary investigations indicated that the unidentified factor in fish meal was partially soluble in hot water, 60 or 80 percent alcohol, and 50 percent acetone.

It remains to be determined whether the unidentified factor (or factors) essential for optimum chick growth and hatchability are identical.

R. M. Bethke, D. C. Kennard, J. M. Pensack, and V. D. Chamberlin

New Rations for Chickens on Pasturage

Based upon 5 years of extensive results and experiences in the feeding of chickens having access to good pasturage, two new rations and a different method of feeding were employed for feeding the Station's 2,500 pullets in 1945. The new rations and

methods of feeding proved so satisfactory that they were repeated in 1946 without change and again proved equally satisfactory.

The new rations were whole grain-mash, all-in-one feed mixtures designed to provide the necessary supplements to good pasturage. The rations were built upon two protein levels of 12 and 14 percent. The 12 percent protein ration and Ladino clover pasturage yielded equally satisfactory results both years, as did the 14 percent protein ration. The 12 percent protein ration enabled a saving of nearly 50 percent of the scarce protein meals.

Since the primary purpose of these investigations was to learn what might be the minimum supplemental feed requirements to secure normal growth of chickens having access to good pasturage such as Ladino clover, a third new ration (the simplest of all) was introduced in 1946. This consisted of approximately 95 percent corn and 5 percent minerals composed of salt, oyster shell, and bonemeal. Surprising as it may seem, the corn and minerals and Ladino clover pasturage yielded equally satisfactory growth of Leghorn and Rhode Island Red pullets as did either of the more complete 12 or 14 percent protein rations.

The chickens were fed about 4 p. m. daily in the amount of the whole grain-mash mixture that would be consumed by noon the following day. Being without feed 3 or 4 hours each day stimulated the birds to greater activity and use of the range.

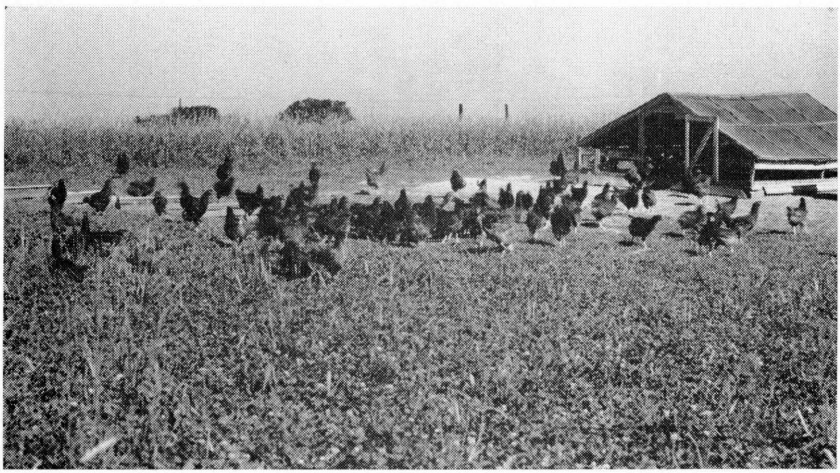


Fig. 10.—Rhode Island Red pullets make good use of Ladino clover pasturage. Good pasturage such as this will lower the need for protein concentrates.

Either of the three rations will enable Ohio poultry raisers to realize a substantial saving in the cost of feeding their growing chickens when they have access to good pasturage. Complete results were published in the January-February, 1947, *Farm and Home Research* No. 244.

D. C. Kennard and V. D. Chamberlin

Hydrated Lime Treatment of Floor Litter for Chickens

Floor litter involves a never-ending problem of time, labor, and expense. Anything that contributes to the simplification of this problem is much welcomed by poultrymen.

Much progress has been made in recent years towards the solution of the floor litter problem. First came the insulation of laying houses, droppings pits, built-up litter practices, and now the treatment of floor litter with hydrated lime.

Fig. 11.—Hydrated lime added to floor litter at intervals, if properly mixed in, seems to have the effect of keeping the litter dry and usable for a great length of time.

Instead of removal and renewal of the floor litter every week or so, as commonly practiced a few years ago, poultrymen can now use the litter in brooder houses 8 to 16 weeks or longer without removal by the use of hydrated lime. The floor litter in well-constructed, insulated laying houses need only be removed once a year. What is more, the treatment of the floor litter of brooder houses with hydrated lime has aided in the prevention or control of coccidiosis—the bane to poultry raisers. In five broods of 2,000 chicks each at the Station's poultry plant during 1945 and 1946, there were no noticeable evidences of coccidiosis. Seldom did a brood escape an attack of coccidiosis before the use of hydrated lime.

D. C. Kennard and V. D. Chamberlin

Farm Crops

New Red Clover For Southern Ohio

In the red clover strain tests at Columbus in 1946, a new disease-resistant red clover for the southern half of Ohio gave extraordinary results. It yielded 3.65 tons per acre in two cuttings, when its nearest competitor, Cumberland, made 2.88 tons.

This new selection, which has just been named "Kenland," is a product of many years' breeding by the United States Department of Agriculture in cooperation with the Kentucky Agricultural Experiment Station. The year 1946 is the first year that seed has been available to put in field plot tests, but it has given equally favorable results in 3 previous years at Columbus in the Nursery Division of the Soil Conservation Service. It will not be commercially available for at least 3 years. Until then, the Cumberland blend is the best red clover commercially available for southern Ohio and Midland or adapted Ohio strains are best adapted to northern Ohio.

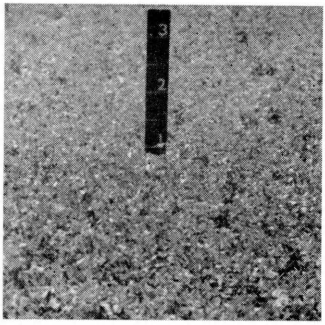


Fig. 12.—Kenland red clover

C. J. Willard

Buy Well-known Standard Alfalfas for Short Rotations

The new wilt-resistant alfalfas, Buffalo and Ranger, continue to give extraordinary increases in yield in the fourth, fifth, and later years of alfalfa stands where bacterial wilt is a factor. In a test at Columbus in 1946, for example, in the fifth year of cutting, the wilt-resistant alfalfas averaged 4.3 tons per acre, the common alfalfas ¼ ton, and the variegated alfalfas ½ ton per acre in three cuttings.

However, purchasers should make no effort to buy these new alfalfas unless they are sure they wish the stand to remain longer than 3 years. As a 3-year average of 4 tests, three at Columbus and one at Wooster, wilt-resistant alfalfas, common alfalfas, and variegated alfalfas (which include Grimm and Hardigan) produced within 0.1 ton of the same yield. As a 5-year average of the same

tests, the wilt-resistant alfalfa made 3.2 tons per acre per year, the commons 2.8 tons, and the variegated 2.6 tons. In the fifth year the variegated yielded less than a ton, the commons less than 1½ tons.

C. J. Willard and L. E. Thatcher

New Soybean Varieties Being Developed

The recently released soybean varieties, Lincoln and Earlyana, are very popular and at present a greater percentage of the total soybean acreage is planted to recommended varieties than ever before. Ample seed of these new varieties is now available.

Several years' data on new strains indicate that two new strains will be increased in 1946. One strain developed in Ohio is about 5 days earlier than Earlyana and stands much better. It is very similar to Earlyana in yield, height, and oil content. Since it is equal to Earlyana in all respects and excells it in lodging resistance and early maturity, it was decided to increase this in 1946.

The other strain that will be increased in Ohio in 1946 is a strain developed in Iowa. It has the same maturity as Richland but excels Richland in yield, height, and oil content. This strain should replace a lot of the acreage now devoted to Lincoln since it is earlier, stands better, and yields as much as Lincoln.

Lewis C. Saboe

Soybean Harvesting Methods Influence Other Crop Yields

Soybeans in a 4-year rotation of corn-soybeans-wheat-clover hay have been harvested by three methods: (1) for hay, (2) for grain with the combine harvester leaving the haulm on the land, and (3) for grain with the grain binder and no haulm being returned. In all other respects the treatments were alike. Fertilizer (0-14-7) was used at the rate of 150 pounds to the acre in the hill for corn, 150 pounds on the soybeans, and 300 pounds on the wheat. The 10-year average yields of wheat and clover and the 9-year average yields of corn and soybeans showed the following:

The largest average yield of wheat, 37.8 bushels, was following soybeans cut for hay. Wheat following combined soybeans yielded 35.3 bushels per acre and following soybeans binder-harvested, 32.9 bushels. The soybean hay was harvested in late August or early September giving 5 to 6 weeks before wheat planting time for the

decomposition of the soybean residues (roots, stubble, and dropped leaves) and the liberation of nitrate nitrogen for the wheat seedlings, whereas, the soybean grain was harvested only a few days before wheat seeding time.

The largest yield of clover hay was in the soybean combine-harvested rotation; an average of 4,885 pounds per acre. In the soybean binder-harvested rotation it was 4,350 pounds, and in the soybean hay rotation only 3,960 pounds. The good yield of clover hay in the soybean combine-harvested rotation is a reflection of the good stand of clover and good seedling growth made in the wheat where the disked-in soybean haulm had a semi-mulching effect. Soybean haulm also contains about 15 pounds of potash per ton which may have been beneficial to the clover seedlings.

So far the yields of corn in the three rotations have been about the same with a slight tendency for corn in the soybean combine-harvested rotation to forge ahead. More trials will have to be made before the significance of this slight lead in yield can be determined.

Combine-harvested soybeans have yielded an average of about 3 bushels per acre more than binder-harvested beans. Most of this difference represents the greater loss by shattering when binder harvested.

L. E. Thatcher and R. E. Yoder

Wheat Lodging Serious on Nitrogen-rich Soils

Wheat lodges badly on many livestock farms where generous applications of manure are applied to the land and on some dark-colored soils which contain much nitrogen in the soil organic matter.

A study was started at Wooster in the fall of 1943 with seedings of wheat in drill rows, 7 inches and 14 inches apart, on land that was heavily fertilized in order to favor lodging and subsequently treated to prevent the lodging or to overcome the bad effects if lodging did occur. Similar seedings were made in the fall of 1944 and 1945. Alfalfa was sown in the wheat in the spring and harvested for hay in 1945 and 1946.

Spacing the wheat rows 14 inches apart resulted in less lodging than spacing them 7 inches apart in the 1944 harvest. In 1945 there was no lodging at either spacing and in 1946 the wide rows lodged somewhat more than the narrow rows. More tests will need to be made before the relative values of 7-inch and 14-inch rows can be determined.

In 1944 the yield of wheat was reduced somewhat in proportion to the amount of lodging. The 14-inch rows lodged less and outyielded the 7-inch rows by about 6 percent, a barely significant amount. In 1945 with no lodging, the 7-inch rows outyielded the 14-inch rows by about 5 percent, and in 1946 the yields were almost identical.

There has been a slight tendency for the yields of alfalfa hay to be larger following the 14-inch wheat seeding: 14 times in 21 comparisons the yield was in favor of the wide rows in both the 1945 and 1946 crops.

L. E. Thatcher and R. E. Yoder

Clipping Wheat Raises Yield of Seeded Alfalfa.

Top-dressing wheat with manure during the winter or very early spring resulted in a gain in the number of alfalfa plants that survived even when the wheat lodged, and the yields of hay were larger than where the wheat was not top-dressed.

The most significant treatment was that of clipping the wheat in the spring. The clipped wheat yielded a little less grain than that not clipped: 2 percent less in 1944, 4 percent less in 1945, and 3 percent less in 1946. In 1944, a lodging year, clipped wheat lodged 5 percent and non-clipped wheat on similarly fertilized plots 25 percent.

The yields of alfalfa hay in 1945 were 15 percent larger and in 1946, 17 percent larger following wheat clipped in the spring of 1944, and in 1946 it was 24 percent larger following wheat clipped in the spring of 1945.

A study is being carried on with this and other experiments in an attempt to isolate and identify the several factors that are responsible for these results: light intensity, soil moisture relations, and nutritive factors are some of the things being investigated.

L. E. Thatcher

Remove Combined Straw to Save Clover

In observations and experiments since 1938, permitting wheat straw to remain on the field as the combine left it has reduced the stand of legumes and the yield of legume hay the next season, the reduction being more or less proportional to the amount of straw present, above 1 ton per acre.

This loss was due in part to mechanical shading out, but more to the dying during the fall and winter of plants that had made a good growth through the straw. This dying was apparently due to diseases similar to "damping off" but no plant pathological studies have been made.

In all comparisons of methods of handling combined straw, the best stands of clover and alfalfa have been obtained by cutting the stubble at once after combining and removing all material at once. With this method as 100 percent, the yield of clean hay after leaving the straw untouched has averaged just 50 percent for the 2 recent years of the test (fig. 13). Cutting and taking all material off a month after combining yielded 95 percent. Cutting at once after combining and letting the material remain averaged 86 percent and removing the combined straw at once, with or without clipping in late August, 90 to 95 percent.

Fig. 13.—Photographed April 7, 1946. *Left*—plot on which combined straw was left undisturbed in 1945. *Right*—plot mowed at once after combining and all material removed.

The recommendations below are based on these tests and many earlier observations:

1) **For dairy and other livestock farms:**

Cut combined stubble at normal hay height as soon as combining is completed, remove straw, stubble, and all for bedding. If less bedding is required than this will make, either remove the loose combined straw and clip later, or cut all just after harvest and leave on the ground that which is not wanted.

2) For grain farms:

Remove just the loose combined straw, cut the stubble just after harvest and remove everything, or cut the stubble just after harvest and leave everything on the ground. If the potash and phosphate which are removed are returned, there can be no objection to selling straw which, if left untouched after combining, so seriously endangers our most important soil-building crops. The organic matter left in the soil after these methods of treatment would be essentially proportional to the hay yields just quoted.

C. J. Willard and R. D. Lewis

Rate of Seeding and Soil Productivity Influence Lodging of Oats

Varieties of oats differ in the strength of straw and their susceptibility to lodging. However, even stiff-strawed varieties may lodge if sown too thickly or on land that is rich in available nitrogen. Rates of seeding tests have been conducted for many years at Wooster and Columbus by the Agronomy Department of the Station. Use has been made of the new varieties of oats as they have been developed and adopted by farmers. In 1945 and 1946 Vicland and Wayne were compared at different rates of seeding and on four levels of soil productivity. The newer varieties now being introduced will be included in future tests.

Some general conclusions to be drawn from these many tests are as follows:

1) There is little evidence that the well-adapted and recommended varieties of oats require different rates of seeding when grown on soils of equal productivity.

2) A rate of seeding should be used which will produce a satisfactory yield of grain without causing the crop to lodge. Lodging is especially undesirable when oats are to be harvested with a combine harvester or when oats are used as a companion crop for meadow or pasture seedings.

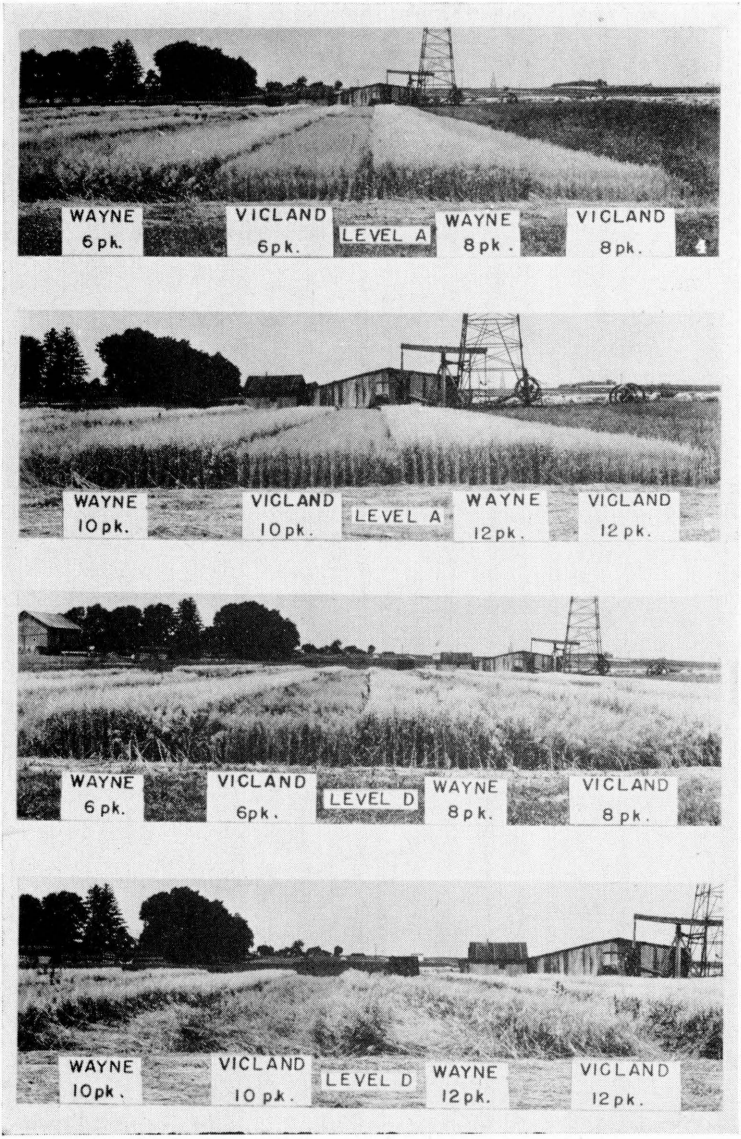


Fig. 14.—Wayne and Vicland oats at Wooster photographed 5 days before harvest. Level A, relatively poor soil—average yield 52 bu.; level D, relatively rich soil—average yield 73 bu.; note the lodging present on the rich soil at heavy rates of seeding.

3) For combine harvesting, a rate of seeding of 8 pecks to the acre will be generally satisfactory. Lodging is not likely to be serious at that rate except on very productive land. Under ideal conditions, the yield of grain will be only 2 or 3 bushels per acre less than might have been obtained by sowing 11 pecks, and, if the 11-peck rate should lodge, the 8-peck rate might easily yield the more (fig. 14).

4) When oats are to be used as a companion crop for meadow or pasture seedings a rate of seeding of 6 to 8 pecks to the acre is recommended, with 6 pecks for the alfalfa or alfalfa mixtures. At 6 pecks per acre in 56 tests over 32 years at Wooster, oats have yielded only 8 percent (4.4 bushels) less than at 11 pecks per acre.

5) A rate of seeding of 10 to 11 pecks to the acre may be justified on soils where the available soil nitrogen is moderate and where the supply of phosphate and potash is ample. For the most part, these high rates of seeding should be used only when binder harvesting is planned.

L. E. Thatcher

Germination Tests With Seed Corn[1]

Seed corn should be dried immediately following harvest if the best quality is to be obtained. At the present time most seed corn is artificially dried with the aid of heat. The temperatures which injure the viability of the seed depend on the moisture still in the grain and on the length of time it is dried.

In order to obtain more specific data on this subject samples of K24 seed from a lot which germinated 100 percent were adjusted to moisture contents varying from 6.6 percent to 17.9 percent. The seed samples then were heated in small tight aluminum cans (to keep the moisture content uniform) in a controlled oven to temperatures ranging from 120° F. to 170° F. for definite lengths of time. After treatment the seed was germinated between wet blotting paper.

Recent recommendations for the storage of carryover seed corn suggest that prior to storage corn should be dried down to between 5 and 8 percent moisture. In the experiments reported here no injury to germination was evident when seed corn containing 17.9 percent moisture was heated to 130° F. for 4 hours or when seed corn containing 6.9 percent moisture was heated to 170° F. for the same length of time. The results obtained suggest that

[1]In cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

seed corn containing 13 percent moisture may be dried safely for a time at 140° F. and that then the temperature may be safely raised to 150° F. or even 160° F. for a short time to finish the drying.

J. D. Sayre

Niacin and Pantothenic Acid Content of Corn

Investigations were begun concerning the factors which influence the niacin and pantothenic acid content of corn. Among the samples analyzed were the following: 8 double-cross hybrids and one open-pollinated corn, grown in each of 10 counties in Ohio in 1945; two of these, plus 7 other double-cross hybrids grown by the Ohio, Indiana, Illinois, Iowa, and Nebraska Experiment Stations in 1943, 1944, and 1945. Available inbred lines and single-cross hybrids, which went into the making of the double crosses, were analyzed also.

Most of the double-cross hybrids averaged from 19.0 to 23.0 micrograms niacin per gram, with some variation due to unknown factors, not marked in any one location or season. Iowa 939 ran consistently higher (23.1 to 29.5 mcgm.; average, 25.4). Eleven of its 14 samples showed higher niacin content than its highest inbred component, based on two analyses of each inbred. Illinois 784 ran consistently lower (14.3 to 20.4 mcgms.; average, 16.9). All samples of this hybrid showed higher niacin content than three of its inbred components (the fourth was unavailable). A majority of the single crosses analyzed showed either a stepping up of niacin content over both inbred parents or a tendency to inherit the niacin content of the highest parent. These effects were less marked in the double-cross hybrids.

Variations in pantothenic acid content have been somewhat inconsistent. Generally speaking, corn grown in 1943 and 1945 by the five experiment stations was of higher pantothenic acid content than that grown in 1944, with much greater seasonal variation in some varieties than in others. In Ohio in 1945, one county yielded corn of pantothenic acid content consistently higher than that of the others. There was a highly significant difference between the pantothenic acid content of corn grown in this particular county and that of corn grown in some other counties.

These investigations indicate that hereditary factors may have more influence than environmental factors on the niacin content of corn, whereas the reverse may be true of the pantothenic acid content.

Charles H. Hunt, Lorraine Ditzler, J. D. Sayre, G. H. Stringfield, and R. M. Bethke

Sweet Corn Breeding

In the name of sweet corn improvements, scandalous things are going on: illegitimate matings of our very proper, regular kinds of corn with uncouth-looking foreigners from as far away as Hawaii, Mexico, Argentina, and Russia. That raw Mexican immigrant sweet corn really looked the part—very tall and late, with poor-looking ears buried in a tremendous husk. But in the hot dry summer of 1944 when most sweet corns were drying up and dying, the foreigner didn't know it was dry, just kept on green and growing. Now if that drouth resistance in the plant could be combined with good kernel quality, we would really have a sweet corn.

Some crosses were made that summer, and thanks to the scheme of growing two generations each year, one in Ohio and one down in the Rio Grande Valley in winter, the third hybrid generation has been matured; but it is too early to talk about that. Some of the grandchildren from the Hawaiian crosses, however, really show promise of combining large, vigorous plants with good eating quality.

Of course, these are not the first cases in which foreign "blood" has been mixed into Ohio sweet corn. Much of the vigor and flavor of Ohiogold 1 traces from a very unconventional outcross of the Bantam inbred, Purdue 51, with a Russian immigrant straight from the Ukraine, a tall, late, flint corn named Kutias. This cross made in 1932 has given us several sweet inbreds, one of which is 51K2, the male parent of Ohiogold 1. Another outcross with an early flint from New York State gave us G192, a high quality midseason inbred.

The reason for bringing flint corn into the breeding program is that flint carries many of the quality factors that are found in the Golden Bantam type of sweet corn. In pure flint corn those edible qualities are concealed by the presence of the starchy factor *Su*. By crossing flint with sweet corn which lacks the dominant starchy factor, a reshuffling of genes occurs in the next generation, resulting in many new combinations. Some plants may be expected to combine into one the desirable stalk characters with the quality factors received from both parents and without the starchy factor, thus a true sweet corn.

New batches of inbreds come along at intervals and go through the process of testing for quality and other things. Most are discarded early in the process, many are mediocre, and a rare few are superior. The problem is to recognize them.

J. B. Park

2, 4-D Kills Many Weeds

Field bindweed and hedge bindweed are among the serious weeds that are readily killed by 2, 4-D, although some regrowth may be expected after one treatment. Other weeds which are readily killed are wild sweet potato or man-of-the-earth, artichokes, chicory (in early stages), wild carrot, evening primrose, and many broad-leaved annual weeds. The standard spray concentration for this use is 0.1 percent, except in dry periods when 0.15 percent is more effective. It kills practically all broad-leaved lawn weeds including dandelions and plantains.

The tops of Canada thistles have been killed by all applications of 0.1 percent solution or stronger, but the roots have not been killed and resprouting has uniformly followed. Eradication of one patch required 6 treatments extending over 2 years. Even so, 2, 4-D is to be recommended for treating Canada thistle in pastures and fence rows, where it is not feasible to cultivate.

Bluegrass in such locations is not killed, nor the soil sterilized as would occur with sodium chlorate. The first application is best made in late May or early June, from early bud to early bloom stages. Later applications may be made as sprouts make 4 to 6 inches of growth.

All forms of 2, 4-D are practically ineffective on crabgrass, nimblewill, quackgrass, Johnson grass, Bermuda grass and other members of the grass family.

Poison ivy is not reliably killed by one application of 2, 4-D, but cost and convenience considered, 2, 4-D is probably the best chemical herbicide for use on this plant. The ester formulations have been somewhat more active on poison ivy and other woody plants than the sodium, ammonium, or triethanolamine salts.

C. J. Willard

The European Corn Borer in 1945

Due to the low temperatures that prevailed in Ohio through May and June, 1945, the emergence of moths of the hibernating generation of European corn borer was considerably delayed over that of the 2 preceding years. As a consequence, there was a low percentage of emergence for a second moth flight in the fall. In early sweet corn fields in the vicinity of Cincinnati in southern Ohio the average fall emergence observed was 44.4 percent, whereas at Elyria in northern Ohio it was 19.1 percent.

However, in spite of the relatively low percentage of fall emergence of moths, the corn borer population survey conducted during the period of September 11 to October 5 showed that a high percentage of the borers in the field were second-generation borers.

In general, late-planted fields carried more borers than early-planted fields. In an area west of Springfield, a number of relatively late planted fields were observed in which the borer population varied from 640 to 1,220 borers per 100 plants. Practically all of these larvae were second-generation borers. In this area it is suspected that the second-generation infestation resulted largely from moths that emerged from first-generation borers in potatoes. It is evident that potatoes are becoming of increasing importance as a host of first-generation borers.

During the summer of 1945, large-scale field tests with insecticides were conducted in the control of the corn borer in early market garden sweet corn. The work was done in cooperation with F. D. Sweet and Son at North Olmsted, Cuyahoga County. Power dusting and spraying equipment was used in making the insecticide applications.

The dusts and sprays were applied four times at 5-day intervals beginning June 28. The dusts used were DDT (3%), rotenone (1%), and Ryanex (50%). They were all applied at the rate of approximately 40 pounds per acre for each application. The spray formulations used were:

1)	DDT	1	pound
	Water	100	gallons
2)	Cube root (5% rotenone)	3½	pounds
	Du Pont Spreader Sticker	½	pint
	Water	100	gallons
3)	Ryanex	4	pounds
	Du Pont Spreader Sticker	½	pint
	Water	100	gallons

The sprays were applied at the rate of 135 gallons per acre with 150 pounds pressure.

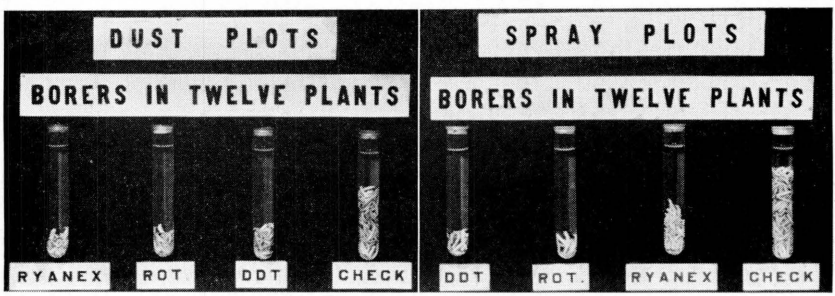


Fig. 15.—Borers obtained by dissecting 12 plants in the dusted plots and by dissecting 12 plants in the sprayed plots, for each type of treatment.

All of these materials, whether used as sprays or as dusts, were highly effective in protecting the ears from severe injury. The DDT and rotenone were somewhat more effective as sprays than as dusts whereas the Ryanex was more effective as a dust. The results may be observed in figure 15 which shows the borers obtained by dissecting 12 stalks per plot in each of two fields.

C. R. Neiswander

Effect of DDT on Leafhoppers in Alfalfa

On July 16, 1945 an alfalfa field heavily infested with and severely damaged by leafhoppers (*Empoasca fabae*) was dusted with DDT.

On July 27 observations were made to determine the effect of the treatment. It was found that in the undusted portion of the field the plants were stunted, yellow, and almost without blossoms. Where the dust had been applied, the plants were growing rapidly, were dark green in color, were blooming profusely and seemed to be in a good healthy condition.

Counts of leaf hopper nymphs on 4-inch terminals of alfalfa plants made on July 27 showed that none were present on the dusted plants, while on the undusted plants there was an average of 2.5 nymphs per terminal. Although adult leafhoppers were found on both treated and check areas, the number of adults on the untreated alfalfa plants exceeded those on the treated plants by more than 3 to 1 as determined from 10 sweeps of an insect net in each area.

TABLE 6.—Insects collected in 10 sweeps of a standard insect net

Insect	Average Number	
	dusted	not dusted
Leaf hopper	52.5	172.8
Spittle bugs (adult)	46.8	99.3
Other Homoptera	2.3	6.8
Tarnished plant bug	9.0	2.3
Other Hemiptera	12.8	14.0
Diptera	11.3	11.5
Coleoptera	1.3	2.0
Orthoptera	2.0	8.0

Harry L. Gui

Silage

Silage from Drought-damaged Corn

Corn silage made from drought-damaged corn was found to have approximately the same chemical composition and feeding value as a silage made from normal corn. Apparently the unfavorable growing conditions had resulted chiefly in a reduction in total yield and in the quantity and quality of the ears produced. Although the so-called "normal" corn was not up to the usual standard, it had been less affected than the other corn, probably as a result of a difference in the soil conditions.

A large percentage of the ears on the drought-damaged corn was denuded of husks at the tips. On many of these ears, a fungus identified as *Fusarium moniliforme* was present, together with an infestation of black beetles and small larvae of the species *Carpophilus lugubris* Murr. There was some question regarding the effect of these conditions on the quality of the silage.

In a feeding trial with milking cows the two silages appeared to be equally palatable. The experimental feeding plan called for a near-minimum use of hay and grain with a maximum use of silage. Under these conditions, no significant differences in the production from these two silages was shown.

C. F. Monroe, A. E. Perkins, and C. E. Knoop

Silo Presses Used to Study Densities

Three series of observations were completed with the silo presses in the 1945 season and three series have been completed and the fourth is in progress for the 1946 growing season.

At 1 pound per square inch pressure, the density of the ensiled crop increased (on the average) only about 9 percent over a 30-day period, while at 16 pounds pressure, the density increased 53 percent in 1 day and 93 percent for the 30-day period. The increase in density was less with dry than with wetter silages at the same pressures.

Leakage from silages seems to begin when they are compressed to a density of about 0.9 that of water or a weight of about 56 pounds per cubic foot. The silage remaining after extensive leakage may have a density greater than that of water.

A. E. Perkins and R. G. Washburn

Bacteria in Silages

It would seem almost a truism to say that the bacteria which are found in silage were incorporated with the green plant material when the silo was filled. If the bacteria found in silage and those occurring on the surface of plants are the same, it should be easy to prove identity. Such is not the case. Typical silage species such as *Lactobacillus pentoaccticus*, *Lactobacillus plantarum*, or *Lactobacillus acidophylus* do not occur with any regularity on plant surfaces and frequently it is impossible to find them at all.

An investigation of the different species of bacteria found on the leaves of alfalfa, clover, or timothy reveals that many of them are yellow in color and facultative anaerobic and transmissible lytic factors can be developed for them readily by using the juices of the plants on which they occur. These secondary forms frequently produce more acid from dextrose than the parent species.

It has also been possible to remove the lytic factor present in some isolates from silage and again restore the original parent form from which the isolates were derived. Typical silage organisms produce acid from dextrose, but where the lytic factor is removed from them they lose this capacity.

R. C. Thomas

Classify Bacteria by Lytic Factors

Many species of bacteria, particularly primary forms, which do not have transmissible lytic factors associated with them, acquire these factors readily when they come into contact with the juices of higher plants, seed extracts, and plant residues. The presence of a lytic factor in a culture seems to modify, in some way, the enzyme system.

Evidence of this is indicated by the failure of a secondary culture to grow in the same medium as the primary culture, by the need for vitamin or amino acid amendments, by change in color, or by the acquired capacity to produce acid from a carbohydrate. This last characteristic is important in silage fermentation.

It is proper to raise the question regarding any species of bacteria as to whether it is a primary or secondary form, that is whether an occult lytic factor is present or not. These facts cannot help but modify our viewpoint regarding the classification of bacteria. Since we can take a primary form and develop a number of different variants or strains with the aid of plant or seed extracts, our conception of what constitutes a species or a strain should be more clearly defined.

R. C. Thomas

Soil Management

Sweetclover Makes Valuable Green Manure

In a test at the Southwestern Experiment Farm in which a 2-year corn-oats rotation with a sweetclover catch crop was established on Miami silty clay loam in 1941 and the first sweetclover plowed under for corn in 1942, the 5-year average increase for sweetclover over no sweetclover is 16.1 bushels of corn per acre.

In the same rotation at the Northwestern Experiment Farm, which has been running since 1930, the average difference in the last 7 years of the experiment is 11.4 bushels. Stands of sweetclover at Holgate were very poor for 4 of those 7 years because of attacks of the sweetclover weevil, or the difference would have been greater. Under these conditions, the yield from using mammoth clover as a catch crop in the same way that sweetclover is used, is only a bushel less than that from the sweetclover.

Fall plowing has been a part of this test since 1940, and for that period the fall-plowed sweetclover has produced nearly 2 bushels per acre more than any spring plowing date. Plowing May 15 has yielded 4 bushels per acre less corn than plowing May 1 during that period.

In the early years of the experiment at Holgate, sweetclover made very little difference in the yield of oats, but the gain for sweetclover in the last 7 years has been 8 bushels per acre of oats, and over a half ton per acre of straw.

C. J. Willard

Soil Building Rotations Respond to Liberal Fertilization

Four-year rotations of row crops, small grain, and 2 years of legume-grass meadow are rapidly becoming accepted by many progressive farmers in Ohio. Properly fertilized and managed such rotations are strongly soil building in character, produce large quantities of grain and forage at low unit cost, improve the drainability and tilth of the land, and lend themselves well to the improvement and conservation of soil productivity.

The fertilization of such a rotation has been investigated during the past decade on Canfield silt loam at Wooster. The crop rotation employed was corn, wheat, and 2 years of alfalfa-timothy.

The basic treatment to all plots including the checks has been lime plus 6 tons of manure and 125 pounds of 2-12-6 to the corn crop. The basic or check treatment has average production as follows: corn, 83 bushels; wheat, 23 bushels; first-year hay, 2.57 tons; and second-year hay, 3.75 tons per acre.

The variable in the experiment has been the amount of fertilizer applied to the wheat. Rate of wheat fertilization was increased by increments up to 1,000 pounds of 2-12-6 per acre. Wheat yields increased from 23 bushels unfertilized, to over 37 bushels per acre from the 1,000-pound application. Rates up to 500 pounds per acre were highly profitable; this rate gave a 13-bushel increase as a 9-year average.

Where the wheat crop received less than 300 pounds of fertilizer, no significant increases in hay yields were obtained (see check yields of hay given above). Increasing the rate of wheat fertilization to 500 pounds per acre gave a residual fertilizer response of an extra two-thirds of a ton of alfalfa-timothy hay. Increasing the rate to 1,000 pounds per acre boosted total hay yields from the 2 years of meadow to 7¼ tons per acre.

The most profitable fertilizer treatment was where the 500-pound rate was divided, 300 pounds to the wheat and 200 pounds as a topdressing to the first-year meadow. Under this system, corn has averaged 90 bushels per acre and wheat has yielded 34 bushels; a total of over 7 tons of hay has been obtained in 2 cuttings per year from the 2 years of meadow.

Farmers who have cropped their land hard during the war period would do well to consider trying such effective soil-building rotations along with optimum use of lime, fertilizer, and manure. The fertilization of the small grain crop, in which the seeding of the soil building sod crop is made, is one of the most important fertilizer applications made during the crop rotation.

R. E. Yoder

Sod Crops, Manure, and Fertilizers Increase Sugar Beet Yields

During the past 3 years a large number of combinations of manure and fertilizer applications have been compared for sugar beet production on Brookston silty clay loam at the Northwestern Experiment Farm. Data obtained from a few of the comparisons are presented in table 7. In this experiment the beet crops followed second-year alfalfa-grass sods in a 4-year rotation; the land was fall plowed.

TABLE 7.—Response of beets to manure and fertilizers

Fertilization		Sugar Beet Yields (3-yr. av. 1944-1946)
In the row	Broadcast before plowing	
		Tons per acre
None	None	4.8
300 lb. 3-12-12	None	7.5
300 lb. 3-12-12	8 tons shed manure	10.1
300 lb. 3-12-12	8 tons shed manure + 400 lb. 10-10-10	10.7*
450 lb. 2-12-6	8 tons shed manure + NPK	10.5*

*Total fertilization identical in quantity.

The above yields were obtained on land that had previously "lost its tilth" as a result of excessive row cropping—a common situation in northwestern Ohio. Furthermore, quantity and distribution of rainfall were adverse during two of the three seasons averaged. Under such conditions incidence of seedling disease was high. Sod cropping, return of manure, and heavy row fertilization have been found to be particularly effective in increasing both stand survival and sugar beet yield; profitable yields were maintained by the better treatments under adverse conditions.

The sugar beet crop has been found to be highly sensitive to soil physical conditions, particularly soil aeration and internal drainability. The regular use of legume-grass sods have been proven to be essential for the regeneration of the favorable soil tilth conditions prerequisite to high beet yields.

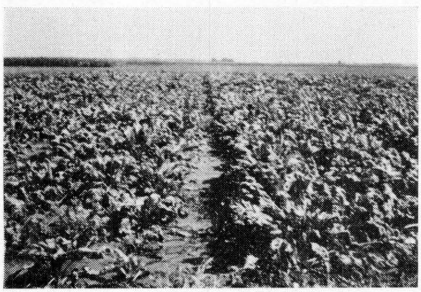


Fig. 16.—Sugar beet experimental plots at Holgate.

During the same 3-year period, 1944-1946, beets receiving liberal row fertilization in addition to 8 tons of manure plowed under with good second-year alfalfa-grass sods in a soil building, 5-year rotation have averaged 13.4 tons per acre. Highly profitable yield levels can be obtained by sugar beet growers by "pyramiding" effective soil management and cultural practices.

R. E. Yoder

Drilled Corn Responses to Heavier Rates of Row Fertilization

An increasing portion of the Ohio corn crop is being drill-planted. Further mechanization and adoption of conservation farming practices will cause the trend to continue. Recommended

rates of fertilization of hill-planted corn have been held down to approximately 150 pounds per acre because of danger of seedling injury and poor yield response from higher rates of hill fertilization during drouth seasons.

Different rates of fertilization were compared on Wooster silt loam for several years on land where the corn crop followed mixed legume grass sods. The fertilizer grade employed was either 0-12-12 or 3-12-12. Nitrogen was not a limiting factor in these experiments since liberal applications of straight nitrogen carriers were applied broadcast prior to plowing as a part of the basic treatment.

In one series of experiments, 400 pounds per acre of 0-12-12 applied in the row with the planter increased the yield of drilled corn from 58 to 70 bushels, a 12-bushel increase as a 5-year average.

In two other experiments at Wooster, six rates of row fertilization were compared. Highest yields with an increase of 10 bushels per acre were obtained from the fertilization rate of 400 pounds per acre drilled in the row at planting. Lower rates were less effective. Increasing the rate of row fertilization hastened the maturity of the crop. There was definite injury to stand at 600 and 800 pound rates, even though the row fertilizer was applied in split bands with a modern planter. These findings were substantiated in principle by results obtained at five outlying County and District Experiment Farms in 1946.

R. E. Yoder

Ohio Soil Survey

Surveys have so far been organized in 38 districts (by counties) of which 9 were supplemental surveys where soil survey maps had been recently published. Complete conservation surveys are already available for 4 additional districts. During the 1945 field season, 7 men (Soil Conservation Service) were engaged in mapping in Ohio. The State has been concerned chiefly with the organization and correlation of the surveys. The surveys include soil, slope, erosion, and land use.

As a result of the suggestion of the Joint National Committee on Soil Surveys, a new basis for cooperation of the State, Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Soil Conservation Service has been worked out. It provides for two types of surveys:

1) Basic Surveys. These will be overall surveys to be completed in a few years. All three agencies will cooperate, the work being inspected and correlated by the federal inspector in cooperation with representatives of the other agencies. The surveys will be published by the Bureau of Plant Industry, Soils, and Agricultural Engineering; they will also serve in farm planning.

2) Farm Planning Surveys. These surveys will be made of farms as a basis for farm planning in Soil Conservation Districts. The Soil Conservation Service and the State will cooperate in organizing these surveys and in making necessary inspections.

G. W. Conrey

Farm Engineering

Ventilation of Corn and Grain

Ear corn husked the first week in October, containing 35 percent moisture in the kernels, may be dried with natural air ventilation by placing flues horizontally across the bin or crib. The flues should be spaced about 3 feet apart. During the winter months it

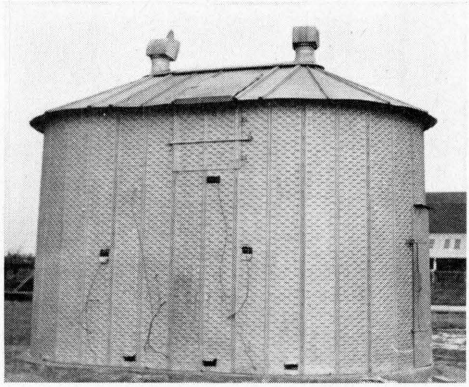


Fig. 17.—Flue openings cut in a 10-foot wide metal crib.

dries to about 20 percent moisture in the kernel. During warm weather (above 50° F.) it will dry to less than 14 percent moisture which is safe for storage in tight bins.

Shelled corn stored in late November at 21 percent moisture, in a round metal bin ventilated with flues, kept in good condition until warm spring weather. The flues were placed across the bin at intervals of 3 feet. The bins were 9½ feet in diameter and were filled about 7 feet deep.

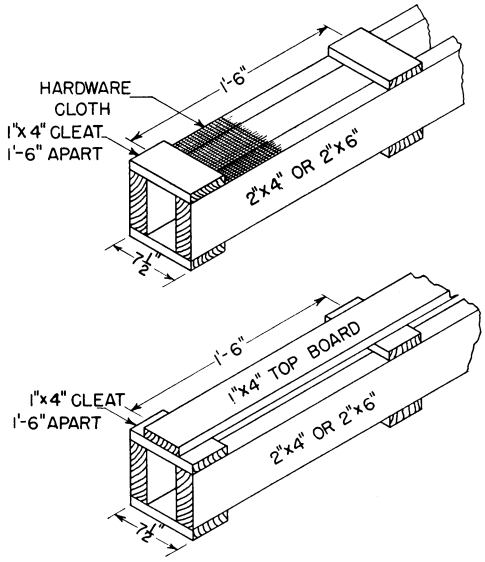


Fig. 18.—Two methods of constructing ventilating flues for ear corn.

Forced ventilation with natural air should deliver at least 2 cubic feet of air per minute per cubic foot of grain or shelled corn and about 5 cubic feet of air per cubic foot of ear corn. Grain or shelled corn should be in shallow bins, that is, not more than 7 feet deep. Ear corn depth should be only about 10 feet. The walls should be solid (not slatted) for best results in forced ventilation of ear corn. Shelled corn and silks concentrated in ear corn storage greatly reduce ventilation which may result in mold or heat damage.

R. C. Miller

Tillage Machinery Tested

As part of the field tests of tillage methods in preparing land for corn on The Ohio State University farm in 1946, a comparison of fuel used and power requirements of the different tillage implements was made. The tests were made on a moderately heavy alfalfa sod which had had a heavy application of strawy manure. The alfalfa was 8 to 10 inches high and the soil was in good working condition at the time the plots were prepared.

Once over with the rotary tillage tools was not enough on this sod. The following are the four methods of tillage used and the average cost per acre, assuming a farm with 75 acres to plow, machinery prices as of May 1947, and labor at 75 cents per hour. In all cases, it was assumed that the tractor was run 500 hours per year.

Method	Cost per acre	Yield per acre in bushels avg. of plots
1. Auger-type rotary tiller and 3-plow tractor over twice plus disc and spike tooth harrow before planting.	$ 6.54	47
2. Tines-type rotary tiller with auxiliary motor and 2-plow tractor over twice.	12.32	61
3. TNT plow with subsoilers set 4 inches below regular bottoms and 3-plow tractor, plus double discing and harrow before planting.	3.63	74
4. 2—14-inch bottom general purpose plow and 2-plow tractor, plus double discing and spike tooth harrow before planting.	3.42	77

R. L. Erwin

Fruits

Irrigation of Strawberries Pays

Results obtained by irrigating strawberries at the Experiment Station at Wooster indicate that this practice may give the grower very satisfactory cash returns for his effort. A planting of Premier strawberries, which was irrigated during the first growing season when runner plants were being established, yielded during the picking season of the following year 5,560 quarts per acre as compared to 2,640 quarts from a comparable planting which was not irrigated.

Fig. 19.—The canvas "ooze" type hose gives good results in irrigating strawberries.

The principal advantage of irrigation in this case was to increase the number of runner plants. If dry weather occurs during the picking season, irrigation would also help improve berry size and yields.

Irrigation of strawberries as a method of increasing the farm income should not be overlooked. Many berry growers could secure water for irrigation by damming a stream or from wells already located on their property.

Wesley P. Judkins

Frost Hits Lower Branches

Some observations made in April 1946, during orchard heating operations at Wooster, revealed striking differences in temperatures at short differences in elevations. These observations also tended to show that frequently local weather bureau temperatures may not be applicable to conditions in nearby orchards.

On the morning of April 28, 1946 at 5:30 a. m. a reading taken in a regulation weather bureau shelter showed a temperature of 26.5° F. while 15 feet above this elevation in a Stayman Winesap apple tree a tested thermometer recorded 28° and at the same time a reading taken on the ground at the base of the tree showed a temperature of 17° F.

It is a common observation that fruit in the tops of trees may survive spring frost damage while that on the lower branches of the same tree may be destroyed. These striking differences noted in the readings taken during the above mentioned observations readily account for the scarcity of apples on the lower branches in the area near where these readings were made.

C. W. Ellenwood

Apple Leaf Color Tells Nitrogen Present

Previous experiments showed that the total nitrogen content of apple leaves was closely correlated with the yield and color of apples produced. Further experiments were carried out during the growing season of 1946 to determine if color measurements of leaves would bear any relationship to total nitrogen determinations and thus indirectly indicate the nitrogen nutrition of the trees.

Color data and total nitrogen were obtained three times during the growing season on mid-leaves of shoots from 1-year-old Stayman Winesap, Cortland, and Delicious trees growing in gravel culture with 0, 15, 60, and 160 parts per million nitrogen supplied to an otherwise complete nutrient solution (fig. 20). Similar data was obtained on leaves from mature Stayman Winesap trees growing under different nitrogen levels and cultural treatments.

Results show a close correlation between leaf color and total nitrogen content of the leaf, especially at the lower levels of nitrogen nutrition. This relationship does not hold when nutritional elements other than nitrogen are limiting, thus causing a change in

leaf color. The best time to sample for leaf color seems to be after most of the current year's terminal growth has been produced, that is, during the latter part of July and the first part of August. The best position to sample is the mid-leaves of the current year's terminal growth.

These and future data will be of value in helping growers judge the nitrogen level of their fruit trees and to determine if it would be economically advisable to use more or less nitrogen fertilizer. The color determinations, being physical measurements, are much more rapid than chemical determinations of leaf nitrogen thus permitting many more samples to be quickly evaluated.

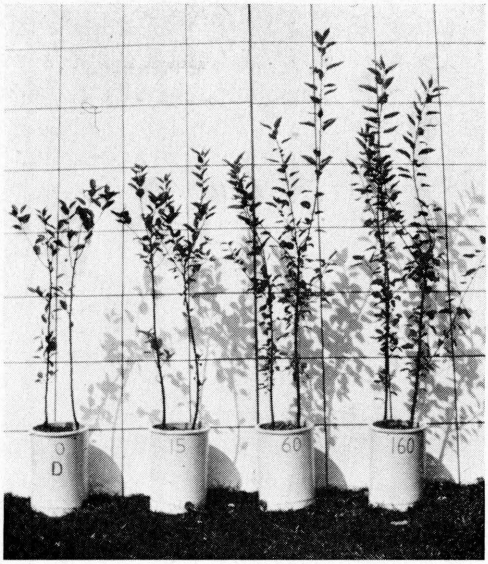


Fig. 20.—One-year-old Delicious trees growing in gravel culture with 0, 15, 60, and 160 parts per million of nitrogen in the nutrient solution. The leaves of these trees were used in the nitrogen studies.

I. W. Wander

Use of Parasites Against Oriental Fruit Moth Larvae

Experiments with large-scale liberations of the parasite, *Macrocentrus ancylivorus*, against first-brood fruit moth larvae were conducted in Ohio for the first time in 1945. The parasites were secured through the cooperation of the Bureau of Entomology and Plant Quarantine, Moorestown, New Jersey.

In three peach orchards of northern Ohio, parasites were liberated against first-brood, shoot-infesting larvae at the average rate, for the entire liberation period, of six females per tree. In two other orchards, liberations were made against second-brood larvae at the average rate of approximately 10 females per tree. Three or four separate liberations were made at 4- to 10-day intervals in both treatments. Three additional orchards which received

no parasites were used as checks. Treatment orchards and corresponding checks were located in the same general vicinity, but were separated by sufficient distances to eliminate the possibility of large-scale parasite migration as a complicating factor in the experiment.

Average rates of parasitization of short-larval populations in the three groups of orchards were, (1) first-brood liberations, 69.1; (2) second-brood liberations, 60.2; and (3) nontreatment, 35.9.

Fruit injury at harvest was determined by examination of a 400-fruit sample from each orchard taken in 20 subsamples of 20 fruits each. Subsamples were taken by a randomized, non-selective technique. All fruits were cut to determine concealed damage.

A more uniform rate of shoot-larval parasitization was observed in orchards in which parasites were liberated against first-brood larvae than in orchards in which liberations were made against second-brood larvae. Also, a greater average reduction in subsequent injury to ripe peaches occurred in first-brood liberation orchards when compared with second-brood liberation. Percentages of fruit injured in the three groups of orchards were (1) first-brood liberation, 18.6; (2) second-brood liberation, 24.1; and (3) nontreatment, 45.0.

Norris D. Blackburn

DDT Controls Oriental Fruit Moth in Quince

In experiments designed to control the oriental fruit moth in quinces with DDT, the material was used at the rate of 4 pounds of a 25 percent water-dispersible powder (1 pound actual DDT) to 100 gallons of water. Treatments were applied to single-block plots of approximately 15 trees each in a small 35-year-old quince planting in Ottawa County.

Initial, early-season spray applications were timed to coincide with the appearance of terminal-shoot injury by fruit moth in nearby peach orchards. Check trees received no sprays of any kind.

TABLE 8.—DDT sprays on quinces for Oriental fruit moth control. Ottawa County. 1945

Treatment	Intervals applied	Dates applied				Percent of fruit injured
		June	July	August	September	
1	20-day	13	3&23	12*	1	4.2
2	30-day	13	13	12*	11	8.5
3	20-day	.....	3&23	12*	1	12.4
Check—no treatment	.....	.....	.....	.....	.....	99.1

*Bordeaux (4-6-100) combined with DDT in this spray for control of leaf spot.

All treatments produced a satisfactory degree of control, although the one in which DDT sprays were applied throughout the season at 20-day intervals was somewhat superior.

DDT residues were in excess of the tentative tolerance of 7 parts per million in all the treatments. Removal of the pubescent covering from the fruit by brushing probably would have removed a considerable portion of the residues.

Norris D. Blackburn

Plum Curculio

A block of 142 peach trees of the Zarn variety and a block containing 118 Stanley and Albion prune trees in Ottawa County were employed in plum curculio studies during 1945. In order to study

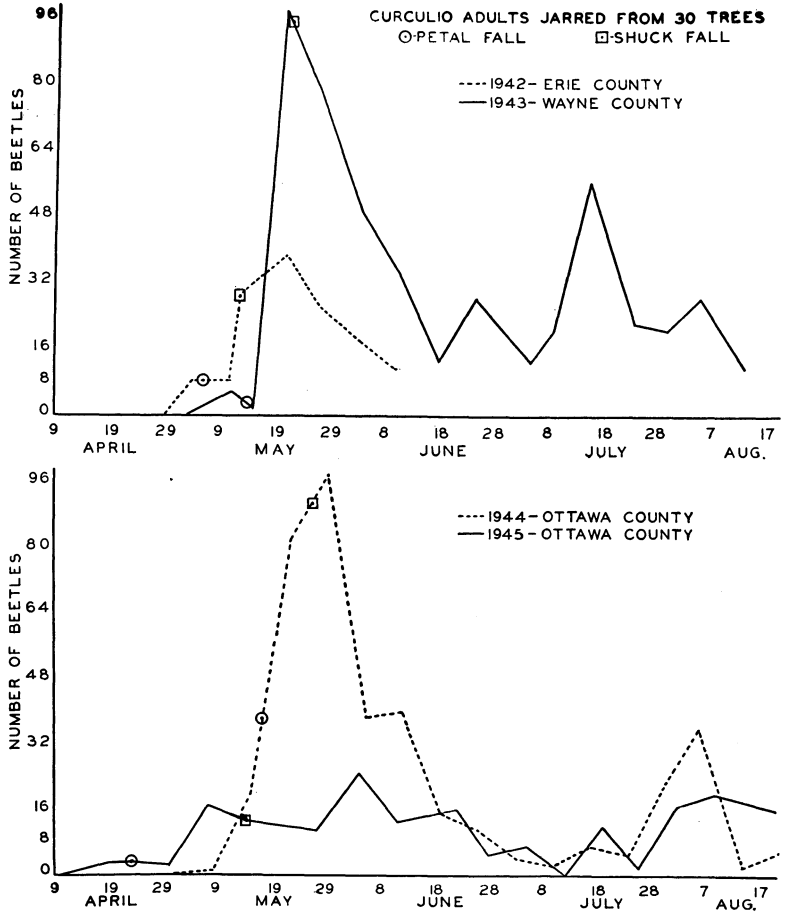


Fig. 21.—Plum curculio population records in Ohio orchards, 1942-1945

Fig. 22.—Method used in making plum curculio counts. Beetles jarred from tree fall on canvas where they are easy to count.

the adult population, the beetles were jarred from 15 trees in each block at weekly intervals throughout the season.

The first beetles were found in the orchard on April 19, but the peak appeared on June 4, or 46 days later. During the four previous seasons, when similar studies were made, the earliest date when beetles appeared on the trees was May 4. That year the peak occurred on May 21. A comparison of the records obtained during the 4-year period is shown graphically in figure 21.

The graph indicates that the adult population in 1945 was relatively low in comparison to other seasons. However, the beetles were active over a longer period than usual; therefore, only a relatively small portion of the population was affected by the shuckfall and 2-weeks sprays.

The cool weather which occurred in May checked the growth of the fruits to such an extent that they remained in a stage suitable for curculio attack longer than usual. Consequently, a relatively large population of larvae developed in the small fruits. An average of 50.9 larvae per 100 fruits was recorded from drop peaches, whereas only 38.7 was recorded in 1944.

R. B. Neiswander

Control of Codling Moth With DDT

In 1945 more DDT was available for experimental use than during the previous season. This permitted the testing of the material at several strengths and in different formulations on a larger number of plots. Also, some growers were supplied with the material so that tests of a commercial nature were available for observation.

The results on experimental plots and in the grower-conducted tests were uniformly favorable to DDT as a control for codling moth.

In figure 23, a graphic presentation of the results of several experimental plots is shown. An examination of this graph shows

four lead arsenate schedules (plots 1, 3, 4, and 8), all of which were reinforced by the addition of extra materials during the second, third, and fourth cover sprays. The graph indicates that DDT was the best of these reinforcing materials. Also, where DDT was used in connection with nicotine, oil, and Mississippi Bentonite, as in plot 6, the control of codling moth was good. On plot 10, DDT was used in all six cover sprays at the rate of 1 pound 50 percent wettable powder per 100 gallons of spray. Even this low dosage gave excellent control. When the same material was used at the rate of 2 pounds per 100 gallons, as in plot 11, codling moth was almost eliminated.

However, not all formulations of DDT were effective, as is shown in plot 16. In that plot an experimental DDT was used with poor results.

All DDT-sprayed plots became heavily infested with the European red mite unless acaricides were added to the spray. In one such plot (plot 6) oil was added to the nicotine—DDT and excellent results in mite control were obtained. Also, plots sprayed with a DDT—DN combination in the latter sprays of the schedule were protected from serious mite damage.

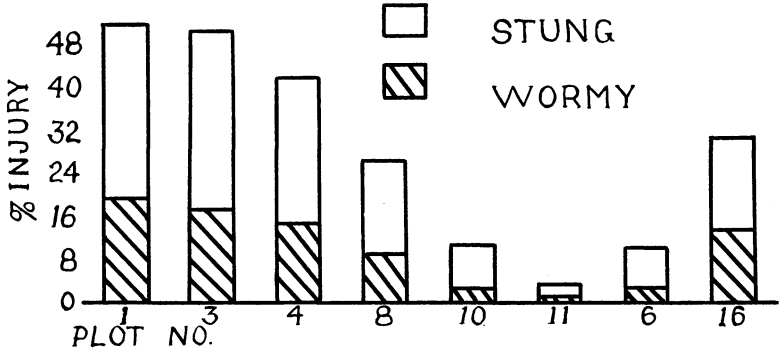


Fig. 23.—Results in spraying for codling moth with the following formulas:

1. **Lead arsenate plus Phenothiazine in three sprays.**
3. **Lead arsenate plus oil in three sprays.**
4. **Lead arsenate plus oil-nicotine in three sprays.**
8. **Lead arsenate plus DDT in three sprays.**
10. **DDT (1 pound 50% wettable powder in 100 gallons) in three sprays.**
11. **DDT (2 pounds 50% wettable powder in 100 gallons) in six sprays.**
6. **Nicotine-oil plus DDT (½ pound 50% wettable powder in 100 gallons) in three sprays.**
16. **Experimental formulation of DDT (1 pound 50% wettable powder) in six sprays.**

C. R. Cutright

New Sprays To Kill Aphid Eggs

Many of the aphids or plant lice that are injurious to different fruits overwinter in the egg stage on the host plants. Prominent among such species are the rosy apple aphid, the black cherry aphid, the current aphid, and some species on gooseberry and raspberry.

Since all these aphids deposit their eggs on the bark of twigs and branches in relatively exposed positions, where they can be easily covered by sprays, much time has been spent in the search for efficient, lethal spray materials that can be used against them. At the Ohio Station such a project has been under way for several years.

In 1938, the first of the dinitro compounds was introduced for experimental use and was found to be quite efficient. This was followed in 1939 and 1940 by other dinitros, practically all of which gave good results. Oil sprays that are so valuable in controlling scale and mites are not effective against aphid eggs, but it was found that if a small amount of dinitro was added to the oil, good control was obtained.

Dinitro compounds used alone or in combination with oil are strictly dormant sprays and should not be applied after the buds swell. They are closely related to some of the dye compounds. The skin and hair of animals and men should be protected from spray drift; otherwise they are dyed a bright yellow. Despite these objections, the effectiveness of the dinitro compounds has rendered them indispensable to fruit growers who are faced with the problem of controlling the overwintering eggs of aphids.

C. R. Cutright

Lime-sulfur Controls Raspberry Anthracnose

Three successive favorable seasons for anthracnose infection have resulted in serious damage to black raspberries even when the recommended delayed dormant sprays of liquid lime-sulfur (5 gallons per 100 of water) have been applied.

During the 1945 and 1946 seasons, Elegetol (dinitro-ortho-cresol solution) ¾ gallon per 100 and Puratized N5-E 1 quart per 100 gallons of water, applied at the delayed dormant stage of growth, gave less control of anthracnose than liquid lime-sulfur at the rate of 5 gallons. Liquid lime-sulfur 8 gallons per 100, on the other hand, gave considerably better control than the weaker dosage.

H. F. Winter

Testing New Fungicides for Apple Scab Control

The results of spray tests conducted in 1945 and 1946 again indicate that Flotation sulfur paste is still the best fungicide for apple scab control. Of the newer fungicides tested, some gave excellent control of scab but were found to cause injury to either fruit or foliage. Other materials failed to give satisfactory control of scab. Fermate (ferric dimethyl dithiocarbamate) gave good results, but for the control of this disease alone is no better than Flotation sulfur and is more costly.

H. C. Young and H. F. Winter

Fermate for Grapes and Apples

Tests conducted during the 1946 season indicate that Fermate (ferric dimethyl dithiocarbamate), as well as Bordeaux mixture, will control black rot of grapes without any of the injury often accompanying the use of this copper spray. Fixed copper materials with lime added were also found effective and safe as a Bordeaux substitute.

Bordeaux mixture 4-6-100 was found to control black rot as well as the 6-8-100 formula formerly recommended for the early spring applications. Fermate is not recommended for the control of downy or powdery mildew.

The results of the bitter rot tests in southern Ohio indicate that the disease can be controlled without the use of copper. Fermate (ferric dimethyl dithiocarbamate), when applied at 2-week intervals beginning June 15 and ending August 15, gave excellent control of not only bitter rot, but also scab, blotch, and rust.

Excellent finish on both yellow and red varieties was obtained with no detectable foliage injury. Copper, either as insolubles or made into Bordeaux mixture, gave severe injury to foliage and fruit russetting.

H. F. Winter and H. C. Young

Fixed Coppers Best for Cherry Leaf Spot

The fixed copper sprays again gave control of cherry leaf spot. When the sticker Orthex was added, the copper could be reduced by one-third, that is, the formula containing 1 pound of fixed copper (50 percent metallic), 2 pounds of lime, and 1 pint of Orthex per 100 gallons of water gave as good control and was slightly safer than the formula containing 1½ pounds of fixed copper (50 percent metallic), and 3 pounds of lime. The inclusion of Orthex resulted in a more uniform coverage.

H. F. Winter and H. C. Young

Vegetables

Green-manure Crops Aid Muck Soils

Various growers of vegetables on the older muck or peat soils in Ohio have expressed the opinion that their farms are becoming progressively less productive with time, in spite of anything they can do in the way of fertilizer applications. Station scientists have examined many of these soils and by means of various chemical soil tests have found them to be in a high state of fertility. Applications of many minor elements in conjunction with varying amounts of the more common plant nutrients have brought no great improvement in crop yields.

Sterilization of the muck did result in substantial increases in yields with celery as the test crop. At present, the large scale sterilization of muck soils seems prohibitive in cost and there is little known as to the permanency of such treatment.

Since 1940, the effect of crop rotation, with and without the use of cover and green-manure crops, has been under test. On one series of plots it was found that plowing down a full summer's growth of soybeans every other year increased the yield of onions

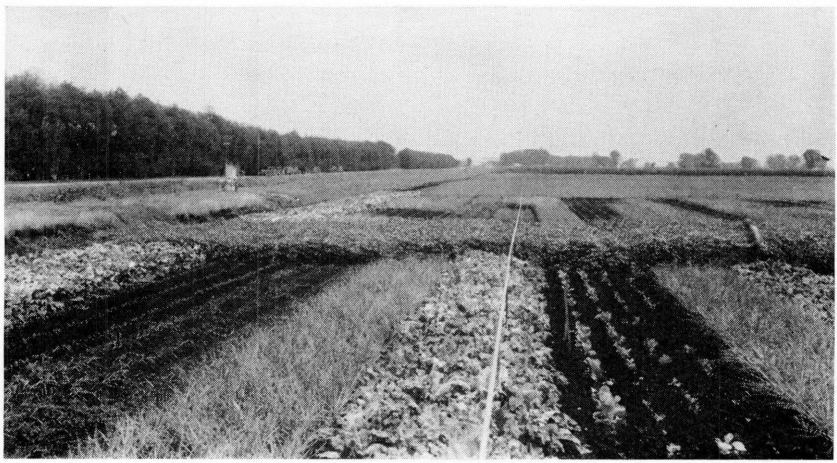


Fig. 24.—View of green-manure crop rotation plots. Note soybean green-manure crop in center section.

by an average of 30 percent at the end of 4 years. The onion yields during 1944 were 722 bushels per acre on the continuously cropped plot and 934 bushels per acre on the plot planted to soybeans every other year.

Other vegetable crops responded similarly with a 32.8 percent increase for celery, 14.3 percent for cabbage, 36.6 percent for sugar beets, and 14.7 percent for potatoes.

Donald Comin

Vegetables Keep Best in Containers

Vegetables and fruits shrivel and lose weight when stored in heated basements, in garages, or other rooms above ground. Most vegetables keep well in an atmosphere nearly saturated with moisture, that is, in the neighborhood of 95 to 98 percent relative humidity. Such a moist atmosphere occurs naturally only in damp locations such as below ground level with earth floor. It is possible to continually add moisture to storage rooms but it requires constant attention and usually some manufactured equipment.

In studying this problem, several vegetables were stored in containers of varying tightness on differing types of storage floors. The results showed that a fairly tight container such as a moisture-proof bag or box was as good as moist soil or sawdust in reducing water loss from the produce. The relative humidity inside the containers was near the saturation point. It was necessary only to close the bags by folding or to fit loose covers on the boxes to maintain the humid condition about the vegetables or fruits.

This method is recommended where it is difficult to maintain the humidity in the storage room at close to 95 percent of saturation. In one test, carrots, turnips, parsnips, and potatoes lost 32, 30, 33, and 7 percent, respectively, of their original weight when stored in crates for a period of 20 weeks. When stored in closed bags in the same dry atmosphere storage they lost only 6, 8, 10, and 3 percent, respectively, of their original weight during the same period.

Donald Comin

Potato Roots Require Oxygen

Because potato plants thrive only in loose, well aerated soil, an experiment has been started to determine the oxygen required by their roots. Plants are grown in jars filled with porous gravel (fig.

Fig. 25.—Apparatus used in testing the effect of oxygen on potato roots. The upright row of bottles contains nutrient solution, the inclined row contains reserve supply of air with concentrations of oxygen (p. p. m.) as indicated on cards.

25), sealed off on top, irrigated through tubes with nutrient solution, and with the air in the jars diluted with nitrogen gas to reduce the concentration of the oxygen to 15, 10, and 5 percent. The check jars are left open and are thus supplied with ordinary air which contains 20.8 percent oxygen.

In the initial experiments the plants survived and the roots grew well with as little as 5 percent of oxygen in the air around the roots, but the growth of the tops was reduced almost one-half. The leaves did not wilt nor turn yellow, as they often do in the field when grown on poorly drained soil. On the other hand, the tubers were small and gnarled at the low oxygen tensions in the jars (fig. 26).

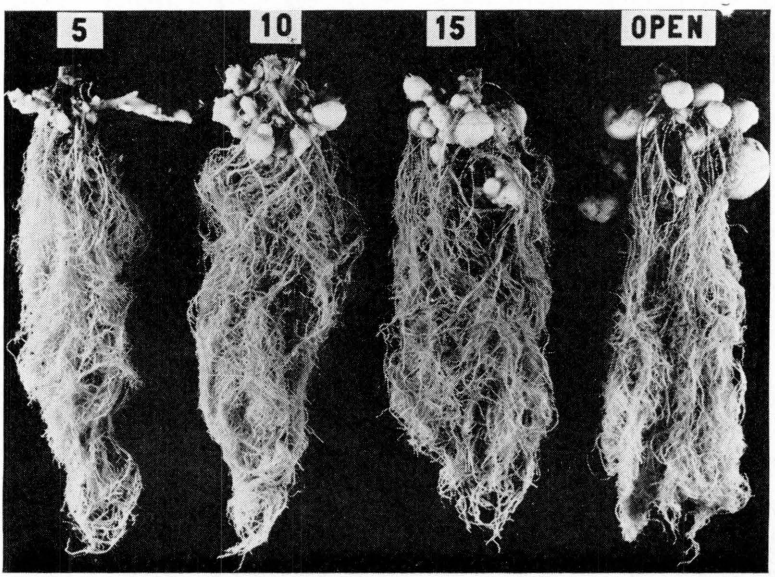


Fig. 26.—Roots of potato plants shown in figure 26.

The experiment demonstrates that a partial reduction of the oxygen in the soil air causes some reduction in growth but does not cause the roots to die. The death of roots and subsequent dying of the foliage must then be attributed to complete absence of oxygen around the roots, such as found in water-logged soil within a few hours after a rain.

John Bushnell

Spacing of Hills for Irrigated Potatoes

Because irrigation of potatoes results in high yields and sometimes oversize tubers, there might be some advantages from planting the hills closer than normally spaced. Tests were made with the Katahdin variety in two plantings, one in early June, the other in July. The yields in bushels per acre, as well as bushels of seed used per acre, are given below.

Distance between hills	Seed used per acre	Net yield of U. S. #1 grade
	Planting of June 5, 1946	
12 in.	23	456
9 in.	30	456
6 in.	45	462
	Planting of July 10, 1946	
12 in.	23	255
9 in.	30	291
6 in.	45	294

The net yield of No. 1 grade potatoes, after deducting the amount of seed required, was not increased in the June planting, but in the July planting the 9-inch spacing was better than the 12-inch. None of the tubers were seriously oversize.

E. K. Alban

New Materials for Spraying Potatoes

In 1945 a number of new organic pesticides, such as DDT and some of the derivatives of dithiocarbamic acid, were compared with calcium arsenate and Bordeaux mixture for the control of potato insects and diseases. Detailed investigations were conducted in three widely separated potato-growing areas of the state.

Data obtained in these experiments show:

1) That DDT, used in combination with various fungicides, gave a 51 percent larger yield (an average of 141 bushels per acre) than was obtained with calcium arsenate when used with the same fungicides.

2) Zerlate gave a higher yield than was obtained with Bordeaux mixture, COC-S, Fermate, or Dithane when each was used with either calcium arsenate or DDT.

3) Zerlate gave good control of early blight (*Alternaria*) but it was inferior to Bordeaux mixture in the control of late blight (*Phytophthora*).

4) DDT completely eliminated the potato leafhopper as a factor in reducing yields.

5) DDT gave better control of the potato flea beetle than was obtained with calcium arsenate.

6) DDT applied at 10-day intervals throughout the growing season gave good control of the green peach aphid (*Myzus persicae*).

7) The addition of calcium arsenate to fungicides was associated in some manner with a rapid build-up in aphid populations.

8) DDT dust gave results comparable to those obtained with DDT sprays when equal amounts of actual DDT were applied by the two methods.

9) Under Ohio conditions, DDT should be applied in combination with a good fungicide.

10) DDT samples obtained from three different manufacturers in the form of wettable powders gave similar results.

11) DDT solubilized in miscible oils gave results comparable to those obtained with wettable powders.

12) The application of 1 pound of actual DDT (2 pounds of 50 percent DDT composition) per acre per application gave results comparable to those obtained when larger amounts of DDT were used.

To secure maximum benefit from DDT in the spray program, growers should apply, at 10-day intervals, 1 pound of actual DDT per acre at each application in approximately 200 gallons of spray mixture. If the amount of spray applied is less than the optimum amount of 200 gallons per acre, the concentration should be increased to provide 1 pound of actual DDT per acre at each application.

J. P. Sleesman and J. D. Wilson

Night Temperatures for Greenhouse Tomatoes

In the spring crop of greenhouse tomatoes planted February 1, 1946, the variety Globe (Wooster Strain A) was grown under a 60° F. and a 70° F. night temperature. The daytime temperature in both houses was maintained as close to 75° F. as is possible under

spring weather conditions. Twenty plants were selected at random in each house and data were obtained from the first through seventh clusters on each plant.

While the total number of flowers was fairly constant for the plants in both houses, there was a 7 percent reduction in the number of flowers reaching full bloom in the 60° house as compared with the 70° F. house and a corresponding reduction in total fruit set. There was approximately 2 weeks earlier maturity of fruit in the 70° house. Although the fruits from the cool house were not as smooth and uniform in shape as those from the warm house, all of the fruits were marketable and of first grade.

Based on the results of this study, it is apparent that as we approach a 70° night temperature yields and size of fruit are reduced and the fruit matures earlier. At the 60° F. night temperature, size of fruit and total yield will increase, but the fruit maturity date is delayed.

H. D. Brown, E. K. Alban, and Carl Condron

Shading Reduces Cracking in Tomatoes

Tomato plants grown for early market in southern Ohio are tied to stakes and customarily pruned to one stem. On the most desirable varieties there is often considerable loss from the fruits cracking shortly before picked.

At the Washington County Truck Crops Experiment Farm tests were conducted to determine the causes and methods of reducing this cracking. The cracking was reduced by shading the plants with glass, or by shading the fruits with the foliage.

Pruning to three stems, instead of one, increased the foliage enough to reduce the cracking. Some fungicides, by preserving the foliage, or perhaps otherwise, also reduced it. Preserving moisture in the soil by straw mulch increased the cracking.

H. D. Brown and Eugene Wittmeyer

Study Life Cycle of Tomato Pinworm

The life history of the tomato pinworm was studied in a limited way during 1945 and 1946. The length of time required for the insect to complete a given stage of the life cycle was influenced greatly by temperature. At an average temperature of 70° F., the length of the life cycle, as determined for 138 individuals, varied from 46 to 68 days and averaged 54.6 days. At a temperature 5 degrees higher, the length of the life cycle, as determined for 38 individuals, varied from 30 to 45 days and averaged 37.6

Fig. 27.—Typical tomato pinworm injury to tomato fruits.

days. Under optimum conditions, therefore, the life cycle can be completed in 1 month. The optimum, however, requires a much higher temperature than that at which tomatoes are usually grown in a greenhouse during the winter months.

At an average temperature of 75° F., the incubation period of pinworm eggs varied from 9 to 12 days and averaged 10.6 days.

The possibility that pinworm larvae might overwinter out-of-doors was studied during the winter of 1945-46. Five outdoor hibernation cages were employed. Infested tomato plants and fruits were collected from heavily infested fields and placed in each cage. About 1,500 larvae were under test.

Two of the cages were placed in an outdoor insectary at Wooster; two were placed in a tomato field at Berea, one over a straw mulch and the other over bare ground; and the fifth cage was placed over a heavy growth of weeds and grass at Elyria.

The five cages were examined at frequent intervals during the spring and were dismantled early in the summer of 1946. No living moths or larvae could be found in any cage.

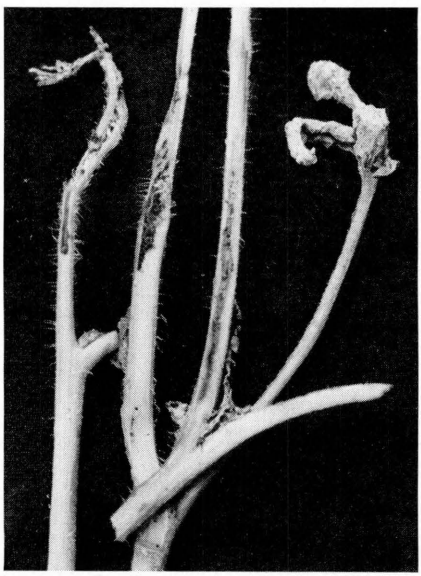


Fig. 28.—Tomato pinworm injury to vines.

The location of infested field-grown tomatoes also indicates that the pinworm does not live over winter out-of-doors in Ohio inasmuch as heavily infested fields have been found only when located near greenhouses in which the insect could live during the winter.

R. B. Neiswander

Keep Tomato Vines Upright

Winter survival of the tomato anthracnose organism, *Colletotrichum phomoides*, in the form of mycelium and sclerotia on decaying organic matter, has been demonstrated by isolation during spring from both sterilized inoculated tomato stems and grain buried shallow in garden soil the previous fall.

Attached green fruits of the susceptible variety, Bounty, have readily inoculated at the green stage with a water suspension of spores; green fruits of Valiant, Stokesdale, and Rutgers have not.

The use of trellises to prevent contact of tomato fruits with the soil has markedly decreased the amount of anthracnose in a 2-year test involving Stokesdale and Mississippi by San Marzano. Trellised Stokesdale had 11.8 percent with anthracnose; whereas, ground plants had 27.2 percent affected. Corresponding figures for the second variety were 9.1 percent and 28.7 percent.

With a low incidence of infection, tomato anthracnose was controlled fairly well by several materials, but Zerlate (zinc dimethyl dithiocarbamate) alone or in alternation with Bordeaux or Tribasic, was most effective. Fermate alternating with a fixed copper was nearly as good. With late blight present, an alternating schedule of Zerlate and Tribasic was superior. The "ethylene bis" compounds show promise since they are effective against both anthracnose and late blight.

H. A. Runnels and J. D. Wilson

Tomato Anthracnose Infection Varies With Variety

A variety trial in 1945, when the incidence of anthracnose infection was low, included 14 tomato varieties. Bounty, with 21.8 percent anthracnose, was highest; John Baer at 10 percent, and Fordhook Hybrid and Ponderosa somewhat higher comprised a middle group; and varieties Baltimore, Marglobe, Pritchard, Scarlet Dawn, Stone, and Valiant fell in a group with less than 5 percent. Jubilee, at 3 percent, was lowest.

H. A. Runnels and J. D. Wilson

Search for a Wilt-resistant Tomato Variety

Selection and yield trials have been continued for the purpose of developing a wilt-resistant tomato variety. Efforts have been directed toward the development of a variety suitable for glasshouse use, Globe type, and the development of a variety suitable for canning and commercial purposes.

The yield data secured in the spring of 1946 for the glasshouse type is shown below:

Progeny	8 lb. baskets per acre	Percent increase over Globe
Globe	8,402.7	———
Selection 1	10,694.7	27.3
Selection 2	10,575.6	25.9
Selection 3	10,880.9	29.5
Selection 4	9,002.0	7.1
Selection 5	9,247.8	10.1

Five selections have been made which yield higher than Globe and which appear to have good quality from the standpoint of flavor, shape, and appearance. Wider tests are being conducted and if they substantiate the earlier results, it is planned to name and release the best selection.

Results of yield tests for certain of the better selections for canning and processing indicate that certain of the selections equal or exceed the commercial variety used for comparison. However, when tried in a field trial (approximately ½-acre plots), the three selections proved to be segregating and in need of further selfing.

L. J. Alexander

New Fungicides for Vegetables

Zinc ethylene bis dithiocarbamate, a material closely related chemically to Dithane D-14, plus zinc sulfate plus lime, was the outstanding fungicide on vegetables in Ohio in 1946. This material ranked at or near the top in each of four experiments on potato spraying, had the same ranking on tomatoes, and was the best of several treatments on celery.

A half-and-half mixture of this material and Zerlate also did very well. Dithane in both the dry and liquid forms gave good control of late blight of potato and tomato. "Bioquin 1" also ranked at or near the top in a list of about 10 new materials that were under test in 1946. Copper-zinc-chromate gave good results on potatoes.

J. D. Wilson

Additional Air Makes Dusts Stick

Variations in particle size of the diluent used in preparing a fungicidal dust mixture with COC-S had comparatively little influence on the amount of copper that adhered to the foliage of dusted potatoes. Also, the copper washed off during rains to about the

same extent regardless of the diluent used or its average particle size. Doubling the amount of air used to blow the dust among the potato leaves caused a much greater difference in the amount of copper that adhered initially and after 10 days of weathering than did diluent variations.

J. D. Wilson

Some New Pesticides Harmful to Plants

Experiments on the influence of various organic pesticides on the growth and transpiration of the host plant showed that many of them stunted growth greatly. By their unfavorable effect on foliage they reduced transpiration to a progressively large degree with the passage of time.

DDT checked both growth and transpiration on tomatoes and slowed down the latter on potatoes. Hexachlorocyclohexane had a similar effect. Methoxy and Rhothane had little effect on growth or water loss of potatoes, but did decrease transpiration of tomatoes slightly.

Dithane in the liquid form, to which zinc sulfate and hydrated lime were added at the time of preparation for spraying, increased transpiration of the potato and tomato nearly as much as did Bordeaux. Zerlate, Fermate, and several other organic fungicides had comparatively little effect on transpiration.

J. D. Wilson

Japanese Beetle

Milky-disease Spores for Beetle Control

The problem of collecting Japanese beetle larvae to be used as media for the propagation of the milky-disease spores was rather involved during October of 1945. Most of the larvae were undersized, due to the lack of soil moisture during the preceding July and August. Heavy populations were restricted to very small areas which had been moist during most of the fall season.

Fig. 29.—Turf rolled back to show larvae of the Japanese beetle present in the soil.

After the larvae were collected, they were placed in earth-filled boxes and stored in a cold room (maintained at 45° F.) until within a few days before they were inoculated. Only 58.8 percent of the larvae were recovered from refrigeration. This is much lower than normal. From this number of larvae, there was obtained 145 pounds of the finished spore dust. The results from inoculation and incubation were the poorest that were ever obtained in the Station laboratory and the same can be said about the number of spores per infected larva.

Effectiveness of the milky-disease spores was again checked and proved to be less encouraging than for the previous year. In all except one instance, less than 1 percent of the collected larvae were infected when incubated for a period of 11 days at a temperature of 85° F.

J. B. Polivka

Numbers of Beetles

The factors that affected the devlopment of the larvae in the fall of 1945 also had prevailed during the preceding year, with the result that there was a noticeable reduction of the insect population in the center of the older areas of infestation. However, there was

a marked increase of the insect approximately midway between the periphery of the known infestation and the original point of infestation. This was especially true in the Cleveland and Youngstown infestations.

The chemical control of Japanese beetle larvae in the soil is also undergoing a change. For some time, lead arsenate has been the only material that remained effective in the soil for several years. This year's work indicates that DDT may replace lead arsenate for this purpose.

J. B. Polivka

Control of Beetles in Grape Plantings

Investigations on the control of the Japanese beetle adult were carried out in the Guernsey County area on grape plantings. Several new materials were used which were checked against the old standard recommended materials.

TABLE 9.—Insecticide tests against Japanese beetle adults on grapes. Guernsey County, Ohio.

Materials	Rate	Percent of	
		leaves damaged	leaf area destroyed
Ryanex	5 lb. to 100 gal. water	17.0	2.2
DDT spray	2 lb. 50 percent wettable powder to 100 gal. water	3.0	.4
DDT dust	5 percent	10.0	1.5
Glue	1 lb. to 10 gal. water	29.0	4.4
Lime	1 lb. to 5 gal. water	8.0	1.1
Smack	1 qt. to 5 gal. water	27.0	4.9
Check	no treatment	33.0	6.1

When DDT was applied as a spray at the rate of 2 pounds of 50 percent wettable powder to 100 gallons of water at different times during the beetle flight, it was found that it was necessary to apply the material more than twice to get a fair degree of control. Four applications gave excellent results, as shown below:

Date of application	Percent of leaves damaged	leaf area destroyed
July 3	37.0	9.4
July 3, 9	17.0	3.3
July 3, 9, 16	13.0	2.2
July 3, 9, 16, 23	5.0	.7

J. B. Polivka

Food and Clothing

Refrigeration of Vegetables Conserves Weight and Vitamin C

A study has been made of the changes in vitamin C values and weights of 14 vegetables during transportation and holding.

Courtesy of Ohio Association of Ice Industries

Fig. 30.—Each vegetable retained its vitamin C best when packed in ice. There was no weight loss for vegetables packed in ice. The vegetables were trimmed and arranged on a bed of ice (1). More crushed ice was placed over the top of the vegetables (2).

Samples were held under the following conditions and tested at intervals: (1) Exposed to air at room temperature, (2) on top of crushed ice in an open display case, (3) buried in crushed ice in a drained metal tray, and (4) in a household refrigerator.

The vegetables were produced on The Ohio State University Farm. The length of the holding period varied with the condition of storage and the vegetables. Leafy vegetables such as spinach, Swiss chard, and leaf lettuce did not keep as long at room temperature as the more compact ones such as tomatoes, cabbage, and asparagus. The vegetables varied as to retention of vitamin C in relation to storage condition but each vegetable retained its vitamin C best when packed in ice and suffered the greatest loss when exposed to air, at room temperature. Weight change data showed that, in general, a rapid loss of weight occurred at room temperature; that the loss was less rapid under refrigeration; and that there was no weight loss for vegetables packed in ice.

Mary Brown Patton

Pasture Carotene Affects Milk Vitamin A

During the pasture season of 1945, carotene determinations were made on the pasture eaten and on the carotene and vitamin A content of the milk produced by three groups of Jersey cows maintained on various pasture seedings. Two groups were pastured on improved bluegrass, one receiving supplemental hay and the other no supplemental hay. The third group was pastured on legume mixtures. A preliminary sample of milk was taken for analysis while the cows were being barn-fed. After the cows were turned out on pasture, samples of both the milk produced and the pasture eaten by the cows were taken near the middle of the pasture periods on the various plots. The pasture samples were usually taken 4 days prior to the milk samples in order to help compensate for any lag in the appearance of the carotene of the pasture consumed and the vitamin A potency of the milk.

It is concluded from the data obtained that the vitamin A potency of milk is very markedly increased by the increase in the carotene content of the roughage such as occurs when changing from winter feed to lush spring pasture. Small fluctuations in the carotene content of the pasture apparently do not markedly affect the vitamin A potency of the milk. When extremely low pasture carotene values occur, as during extended drought periods, the

vitamin A potency of the milk approaches the barn feeding level. The year 1945 was a good pasture season; thus milk vitamin A potency was fairly high except during a few short dry periods.

J. W. Hibbs and W. E. Krauss

Minerals Affect Vitamins in Swiss Chard

The influences of nitrogen, calcium, potassium, phosphorus, magnesium, iron, and manganese deficiencies upon the ascorbic acid and carotene content of Lucullus Swiss chard were investigated.

Significantly lower carotene values were obtained from plots deficient in nitrogen, magnesium, and iron. Significantly higher ascorbic acid values were obtained from plots deficient in nitrogen, magnesium, manganese, and potassium.

Ascorbic acid contents obtained from plots to which double the amount considered adequate of the element in question was added were significantly lower in the case of the double nitrogen, double potassium, and double phosphorus plots. Other elements studied had no significant effect on either carotene or ascorbic acid.

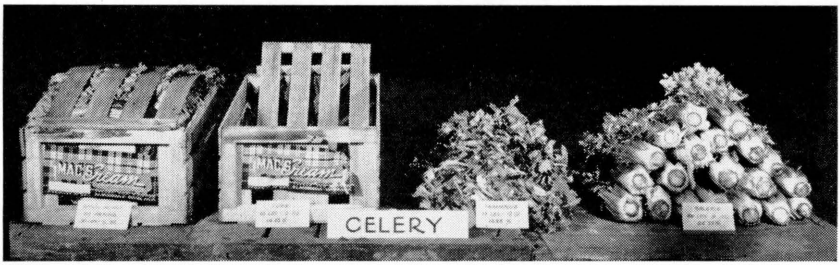
H. D. Brown, Mary Brown Patton, M. R. Shetlar, and Amelie Blythe

Reducing Food Waste

Wastes accompanying conventional handling and distribution of perishable foods are shocking. Authorities agree that about one-fourth of all food produced never reaches consumers.

Records in a supermarket of a corporate chain grocery company in Columbus revealed that necessary trimming, sorting, and reconditioning in that conventional retail produce department were resulting in damage and losses like these: bunched beets, 36.1 percent by weight; cauliflower, 32.3 percent; head lettuce, 20.4 percent; broccoli, 14.8 percent; and thus on down to the so-called "hardware" items like apples, potatoes, dry onions, and citrus fruits which showed smaller losses. Losses on a wide range of commodities, both winter and summer, averaged in the neighborhood of 30 percent.

Comparisons were made between amounts of waste in 6 conventional stores and in 5 stores converted to refrigerated self-service of prepackaged produce, trimmed and sealed in transparent consumer units. Direct comparisons of carrots, cauliflower, celery,



Gross weights on arrival	Tare	Trimmings	Salable
70 lbs. 5 oz.	10 lbs. 0 oz. 14.22%	13 lbs. 12 oz. 19.55%	46 lbs. 9 oz. 66.23%

Fig. 31.—Weights and wastes in marketing celery.

sweet corn, head lettuce, and tomatoes revealed an aggregate retail waste of 17.3 percent by weight when offered in bulk, reduced to 1.8 percent when prepackaged.

Warehouse waste (trimmings disposed of in prepackaging) averaged 25.8 percent, but this did not reduce the amount of edible food nor the number of salable units. The number of bunches of carrots was not lessened by removal of the tops. As many salable heads of cauliflower were delivered to the retail stores after stems and leaves were trimmed off. Removal of husks from sweet corn in the packing room did not alter the number of salable ears.

Refrigerated prepackaging may be credited with very real reductions of waste.

Charles W. Hauck

Fabrics

The breaking strength of the flannels and serges was measured. With one exception, all of the fabrics were considerably stronger in the warp than in the filling direction when dry or wet, and after 20 launderings. All of the fabrics were weaker when wet, the total loss of strength in pounds being greater for fabrics made from synthetic fibers than for wool fabrics.

When the dry strength was determined after 20 launderings, all of the fabrics lost strength in the warp direction, the total loss in strength in pounds being greater for the fabrics made from a combination of rayon and casein fiber than for those made from rayon alone. Probably because of shrinkage, all but one fabric gained slightly in filling strength after 20 launderings.

Florence E. Petzèl

Pockets Tested For Strength

The differences among pocket corners in terms of strength in pounds were relatively small. The rectangular stitching at corners tended to be the strongest in the two weakest fabrics, but the retraced stitching tended to be strongest on the strongest fabric. On the basis of strength, 11 stitches per inch appeared to be somewhat preferable to 8 stitches per inch, but there seemed to be little advantage in using 14 stitches per inch. Variations in the kind of thread did not produce very noticeable effects.

The kinds of tears or breaks varied perceptibly with certain factors. When the fabric was strong, the stitching usually ripped, but the fabric seldom tore. Tearing of the fabric was much more prevalent among the two weaker fabrics. Retraced stitching was associated with vertical tears of the fabric beneath the pocket. This tendency for vertical tears to occur with this type of corner increased with increasing numbers of stitches per inch in the strongest fabric.

Rectangular stitching at the corners was associated with slight fabric breaks at the corners and frequent right-angled tears of the fabric beneath the pocket. When the stitching was extended into the fabric above the pocket without any further finish, the thread tended to rip without tearing the cloth when 8 stitches per inch were used. When 11 stitches per inch were used in constructing this type of corner, there was slightly greater tendency for the fabric to tear; and when 14 stitches per inch were used, the fabric of the pocket tended to tear along the line of stitching, especially in the lower grades of fabric.

A later study of a greater variety of pocket corner constructions indicated that a diagonal type of stitching was the most satisfactory type of pocket corner investigated. A comparison of results obtained by testing pockets on the pendulum and incline plane machines showed that higher values in terms of pounds were obtained with the incline plane machine.

Florence E. Petzel

Ornamental Plants

Hydrangeas

Blindness or failure to produce a flower is a common fault of many commercially-grown plants. It has been said that blindness is inherited and cuttings from blind wood produce blind plants. Tests show this to be erroneous. Cuttings from plants that produced only blind wood were grown and all shoots flowered the following Easter. This was accomplished by growing the plants under lath during June and July and then exposing them to full sun. By placing them in a dark storage (45° F.) in November and December, they ripen properly and force uniformly.

Leafbud cuttings make plants fully as satisfactory as stem cuttings, but a soil low in fertilizer is essential in the early stages, if they are to grow and become established in small pots. Once established, they may be fertilized in the same manner as stem cuttings.

Alex Laurie and D. C. Kiplinger

Chrysanthemums

The quality of the sprays on pompons and the stem development on standard chrysanthemums can be regulated by the date of pinching. Briefly stated, the date of pinching governs the time of formation of the crown bud. The crown bud is desirable if placed high in pompon sprays, but it is undesirable in standards as it causes crooked stems. The reason for this is that on standards, the crown must be removed as it does not develop into a perfect flower and it is necessary to select one side shoot which develops immediately below the crown bud. The exact dates for pinching the innumerable chrysanthemum varieties will require additional experimental work.

Alex Laurie and D. C. Kiplinger

Carnations

The subirrigation of carnations is a labor-saving method of watering the plants provided watertight benches are available. Tests conducted show that subirrigation in spring, summer, and

fall is practical, but in winter overhead watering is preferred when quality and quantity of flowers are being considered. Soil was subirrigated by injecting water from beneath until the water level flooded over the top of the soil.

To obtain maximum production per square foot with marketable quality, various spacing tests of carnation plants were established. The results showed that the 8- by 8-inch spacing on average-sized plants was most practical although small plants should be set two to a hill to insure an adequate number of stems per 8-inch spacing. It appears that 8 stems per hill is most satisfactory, as fewer stems do not give the desired production per square foot. Tests of several varieties grown in both soil and gravel culture showed that plants in gravel consistently produce more flowers of better quality than soil-grown plants.

Alex Laurie and D. C. Kiplinger

Greenhouse Roses

Because this is a greenhouse plant of high initial cost, various spacing tests were established to determine the feasibility of greater planting distances than the usual 12 by 12 inches. Although plants spaced farther apart gave slightly increased production per plant compared to 12- by 12-inch spacing, the production per square foot was highest on the 12- by 12-inch spacing. It is more profitable to bench roses at 12 by 12 inches as more flowers can be cut per square foot.

Subirrigation by injecting water in the bench until it floods the surface is a satisfactory means of watering roses in spring, summer, and fall. In winter, overhead watering is preferred when quantity and quality of roses is considered.

Alex Laurie and D. C. Kiplinger

Outdoor Roses

Trials were made with the use of mulches on three varieties of Hybrid Tea roses. Replicated plots were set up as follows: (1) check, (2) sphagnum peat moss mulch, (3) ground corn cobs mulch, (4) Chewings fescue, (5) Portulaca, and (6) Dutch white clover. On the basis of bloom production over a 2-year period, the different mulches rank as follows from the best to the poorest: ground corn cobs, Portulaca, check—no cover, sphagnum peat moss, Chewings fescue, Dutch white clover.

L. C. Chadwick

Value of Tree Paints as Wound Dressings

These studies were started in 1941 on English Elms. An average of twelve limbs per tree were removed ranging from 2 to 12 inches in diameter. The health of the tree, the health of the limb removed, the angle of the limb of the tree and the direction in which the wound faced were noted. Patterns of the wound area were traced on graph paper and have been redrawn as healing progressed. In addition to three commercial paints, Bordeaux-linseed-oil paint and shellac were used as wound dressings.

Shape of the wound seems to be the most important factor governing the rate of healing. The rate of healing does not seem to be affected by the health of the limb removed, the direction it faces, or by the angle of the branch to the tree. The efficiency of the individual wound dressing varied with the size of the wound. Large wounds seemed to be healing somewhat the best when treated with Toch Brothers paint. Leonard's paint and Southport's "Sav-a-tree" were good, with shellac and Bordeaux following in that order. On medium-sized wounds little difference was detected between the three commercial dressings. On small wounds, Toch Brothers and Leonard's paint showed the best results with shellac and Sav-a-tree being nearly as effective.

L. C. Chadwick

Breed Flowers to Resist Disease

Strains of China asters have been selected for resistance to Fusarium wilt for the past 6 years. As a result of this work, highly resistant strains of purple, rose, white, and pink royal type asters are now available.

Seed of these resistant selections was produced by the Ohio Florists' Association in 1946 and will be available through seed supply houses for planting in 1947.

Forty-seven varieties of carnations have been tested for resistance to bacterial wilt and root rot caused by *Phytomonas caryophylli* Burkh. Varieties which have shown a high degree of resistance are: Puritan, Dairy Maid, Peter Fisher, Dark Pink Fisher, White Fisher, Derigo, Marchioness of Headfort, Seth Parker, Briry, and Dimity. The following varieties are very susceptible: Woburn, Pollyanna, Maine Sunshine, Virginia Rose, Yellow Gold, Pelargonium, King Cardinal, Charm, Spitfire, Coronet, Virginia Supreme, Virginia Dare, Dorothy Napier, and Miller's Yellow.

In soil culture the disease can be controlled by soil sterilization and a rigid program of roguing and selection to obtain healthy planting stock. Experiments so far have failed to indicate effective control measures when susceptible varieties are grown by gravel culture methods.

Paul Tilford

Spray Taxus to Control Grape Mealybug

The grape mealybug, *Pseudococcus maritimus* (Ehrh.), rarely damages grape in Ohio. Within recent years, however, it has damaged Taxus in permanent plantings and since 1943 it has become a troublesome pest in nurseries in Ohio and in other states in which Taxus is grown on a commercial scale.

Because of its more prevalent occurrence on Taxus, frequently the insect is given the common name Taxus mealybug.

The grape mealybug overwinters as a newly hatched individual within the shelter of bits of dead foliage and other debris webbed together with waxy threads secreted by the mother insect. For the most part, these masses are located on the main stem of the Taxus plants. In April and May, most of the tiny mealybugs leave their winter quarters and establish themselves on the twigs on which they feed after the manner of plant lice.

Development is slow during the cool weather of late spring and early summer; therefore, mature females are not found until June. In late June, eggs are laid which produce a brood of adult females in the fall and these in turn deposit eggs from which hatch the overwintering brood of young.

The optimum time to control the grape mealybug is in May after the small bugs have migrated to the twigs. Of the several formulas tried for the control of this insect, the one that has been most effective consists of:

Loro	1 pint
Du Pont Spreader-Sticker	3 ounces
Water	50 gallons

Two applications are required. The first should be made after the small bugs have migrated to the twigs and have started to develop in size. The second should be made about 10 days later. Extreme thoroughness in spraying is essential to success, especially with the compact-growing types of Taxus.

Some nurserymen have had fair success in control by spraying in July when the individuals of second brood of young are abroad.

R. B. Neiswander

Forestry

Harvest Trees as They Mature

Actual timber sales in Eastern Ohio were studied in order to obtain information which might point out ways to improve present marketing practices.

At present about one-sixth of the area is in forest. Farm woodlands in the area studied average about 19 acres per farm having woodland. Fifty-six percent of the timber production came from woodlands containing 40 acres or more.

The study showed that greater emphasis should be given to the trucking of logs to a central point for milling in order to make possible smaller and more frequent harvests from a high proportion of the woodlands.

A more complete treatment of this subject may be found on page 8 of the *Farm Income and Living* section of this Annual Report.

O. D. Diller

Experimental Forests

Another project which has been in progress during the past year is the establishment of experimental forests throughout the state. The objective of this project is to place a number of selected areas on an intensive sustained yield basis to determine the financial and silvicultural aspects of selective timber management under short cutting cycles.

Fig. 32.—A sign similar to the one pictured here is posted on each experimental forest in the state.

To date, permanent sample growth plots have been established in six privately owned woodlands and on three publicly owned tracts. Plans are to eventually place one experimental area in each county in Ohio under management and to remeasure these areas at 5-year intervals.

O. D. Diller

Farmers Plant More Trees

The orders for trees totalled 2,205,969, an increase of 17 percent over the number shipped in 1944. This year there were 1,303 cooperators, an increase of 10 percent. The number of cooperators fluctuated less during the war years than did the number of trees shipped, reflecting the desire of most cooperators to plant trees, but their inability to get help to do the work. As a consequence they ordered what they could plant alone.

Fig. 33.—Use of this converted celery transplanter in transplanting seedlings speeds up the program by making more trees available for planting.

The number of cooperators who were "repeaters" was approximately the same as in past years. In 1942, 66 percent were new customers and in 1943, 52 percent were new. This year it was 65 percent.

Robert R. Paton

Farm Foresters Serve Timber Owners

During the year 164 woodland owners were visited and given assistance on management or marketing problems. In most instances the trees which were ready to market were marked and estimated as to volume and quality. The farm forester rendered

further assistance by helping the owner contact the timber buyers who might be in the market for the kind of logs to be sold.

Over 8,500 acres of timber land were included in the service program and, while it is only a small fraction of the total woods area of the state, it does appear to be a promising means of stopping some of the butchering of the young timber and effecting the harvesting of overmature trees both of which are important steps toward better forestry.

O. A. Alderman

Favorable Weather Reduced Forest Fires

The spring fire season started about the middle of March with exceptionally warm weather which continued well into April. During this period numerous fires occurred in all districts. Rains at fairly regular intervals reduced the number of fires for the balance of the season which ended about May 10. The spring fire season ended with less than half the usual number of fires.

Fig. 34.—Because of rough, rocky terrain, much fire fighting in Ohio is done with hand tools.

The weather during the fall fire season was also very favorable. Very few fires occurred and none became large.

Ohio is behind most states in the use of radio for fire control.

State owned planes are about half as expensive as private ships used on a contract basis. More effective patrol could be had for lower cost if ships were purchased by the state and flown by permanent employees.

Robert R. Paton

Weather

For the Year 1945

The weather at Wooster, which has been recorded for 58 years, was more nearly average than any of the previous 5 years.

The yearly mean temperature was 49.4 degrees Fahrenheit, a departure from the long time average of only 0.1 degree. January was 9.7 degrees colder, and March, 9.6 degrees warmer than the average. Other cold months were May and December.

Rainfall was 1.21 inches above the long-time average of 37.9 inches. March and September were the 2 wettest months, both having about 2½ inches more rainfall than the average month.

July and August were the 2 driest months, and were 1.05 and 1.82 inches below average in rainfall, respectively. This condition aided much in the use of grain combines and pick-up hay balers.

The last killing frost in the spring occurred May 11 and the earliest frost in the fall occurred on October 4, giving a growing season of 145 days, which is 8 days shorter than the 52-year average.

The annual climatological summary for Wooster and the State of Ohio was printed in the March-April, 1946 *Bimonthly Bulletin* of the Ohio Agricultural Experiment Station, Volume 31, Number 239. Similar data for the previous 57 years may be found in previous bulletins of this Station.

J. T. McClure

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Research Projects*

Department of Agricultural Engineering

The application of natural and forced ventilation to farm grain and corn storage.

The curing of partially field-cured hay in the mow by means of natural air ventilation.

The farm freezing plant.

Tillage practice in relation to soil structures and crop response.

The storage of vegetables on concrete and wood floors and means of shrivel control.

Grass silage.

Department of Agronomy

Development of improved methods of breeding corn.
Field performance trials of corn hybrids.
Effect of planting method and fertility level on yield and quality of corn.
Harvesting characteristics of corn hybrids with emphasis on field shelling.
Hot weather legumes for permanent pastures.
Wheat competition in nursery tests.
Development and testing of improved wheat varieties.
Development and testing of improved oat varieties.
Development and testing of improved barley varieties.
Pastures for chickens.
Heavy fertilization of a soil-building rotation.
Rates of nitrogen for corn following grassy sods.
The Ohio soil survey.
Physical and chemical characteristics of Ohio soils.
Mineral composition of the soils of Ohio.
Fertilization of soybeans.
Defoliation of soybeans with cyanamid dust.
The Fry farm crop rotations experiments.
Grain versus livestock system of farming.
Preliminary evaluation of new forage crop varieties and strains.
Methods of obtaining satisfactory meadow seedings in rank-growing wheat.
Sweet clover breeding and strain testing.
Smooth bromegrass culture, breeding, and strain testing.
Culture and rotation experiments with soybeans.
Control of field weeds.
Evaluation of new and standard strains of red clover.
Lead arsenate for control of crabgrass and annual bluegrass.
Ground cover for use under shade trees.
Turf culture.

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*The purpose of this list is to show the fields in which work is being done—the exact wording of project titles is not used in all cases.

Fertilization of long-lay meadows.
Breeding and evaluation of improved alfalfa strains.
Time of cutting principal hay crops.
Establishing legume-grass meadows without plowing.
Rate, grade, and placement of fertilizers for sugar beets.
Crop rotations for sugar beet production.
Time and extent of seedbed preparation for sugar beets.
Use of manure, fertilizers, and residues in sugar beet production.
Use of lime, fertilizers, and manure on crop rotations on major soil types.
Mulch culture versus plowing for corn and small grain production.
Lime and phosphate studies.
Rate, grade, and placement of fertilizers in four-year rotation.
Methods of applying manure.
Rates of liming for common field crops.
Minor element fertilization of field crops.
Rate of fertilization of wheat.
Cover crops for continuous corn.
Rejuvenation of eroded land.
Five-year fertility experiments.
Fertilization of crops in continuous culture.
Barnyard versus shed manure.
Factors in the utilization of mineral nutrients by plants.
Response of wheat varieties to climatic and soil factors.
The mineral nutrition of corn.
Breeding field corn for Ohio.
Sweet corn breeding.
Potash and nitrogen fertilization of corn and oats as affected by sweet clover and residues.
Production and utilization of legume-grass forage crops on the dairy farm.
Causes of soil structure deterioration and methods of restoring favorable structure.
Tillage in relation to soil structure and crop response.
Value of crop residues with sweet clover for green manure.
Processing, preservation, and utilization of meadow crop silages.
Factors influencing the success of seedings of forage crops.
Effects of fertilization and watering on yield and persistence of forage grasses and legumes.
Sub-normal soil moisture as related to failure of grass seedings.
Development and evaluation of improved soybean varieties.
Factors affecting the behavior of native and added potassium in soils.
Effect of liming on the movement and availability of potassium in soils.
The nutrition and physiology of soybeans.
Fertilizer placement for corn.
Management of greenhouse soils for vegetable crop production.
Availability of plowed-under fertilizers.
Seed corn storage investigations.
Agricultural value of blast furnace slag.
Effect of different liming materials on soils and plant growth.
Soil aeration in relation to nutrient uptake by plants.
Planned combinations of practices for red clover seed production.

Study of magnesium in soils and its effects on crop growth.
Effect of chemical and physical soil factors on the growth and development of soybeans.

Department of Animal Industry

Crossbreeding beef cattle.
The influence of different amounts of protein concentrate on the utilization of the cob content of corn and added cob meal ration for fattening steers.
Returns per acre in fattening steers. Silage versus corn-and-cob meal.
The special value of certain animal products in the nutrition of the growing chick.
Factors affecting the niacin and pantothenic acid content of corn.
The factors of the vitamin B complex concerned in the nutrition of the pig, with special reference to pantothenic acid.
The vitamin B complex content of grains and forage crops as they are affected by the kind and amount of fertilizer applied to the soil.
Nutritional factors affecting the production and hatchability of hen's eggs.
Mastitis in cattle.
The relationship between infectious enteritis and nicotinic acid deficiency in swine.
Digestion studies with cattle:

(a) The value of ground corn cobs when added to an all-alfalfa hay ration for steers.

(b) The influence of level of protein upon the utilization of ground corn cobs in steers rations.

The use of crystal violet vaccine for immunization of swine against cholera.
Supplements to soybean oil meal in rations for economical egg production and hatchability of eggs.
Egg production as affected by different sources of calcium with and without hard grit.
Egg production, feather picking, and cannibalism as affected by the ration.
Rations and methods of feeding Leghorn laying pullets.
Rations and methods of management for growth of chickens.
The use of outbred and of inbred lines in hog production.
Amount of protein supplement and methods of feeding protein supplement to pigs on pasture.
Improving soybean oil meal for feeding with corn, ground alfalfa, and minerals to pigs in dry lot.
Crossing inbred lines of hogs of different breeds.
Legume grass silage for sheep.
Legume grass silage for fattening lambs.
Corn-and-cob meal for fattening lambs.
Types of sheep for Southeastern Ohio.
Adaptability and place of Columbia sheep in Ohio.
Meadows and pastures for hay and forage.

Department of Botany and Plant Pathology

Control of soil-borne diseases of glasshouse vegetable crops by nutrient solution culture.

Comparison of vegetable seed treatments with particular reference to the influence of environmental factors.

Study of dust mixtures and dusting machines for vegetable disease control.

Methods of fertilizing shade trees and the effect of fertilizer on tree vigor as determined by rate of growth and disease resistance.

Apple measles disease or internal bark necrosis of apples.

Control of seedling diseases of sugar beets.

The diseases of shade and forest trees and other woody ornamental plants.

Apple tree root rot.

Influence of methods of application, adhesives, and leaf character on initial deposit and weathering of spray materials.

Study of Phloem Necrosis disease of elm.

Fusarium wilt of China aster and diseases of other floral plants.

Investigation of glasshouse vegetable crops production with special reference to determining the causes and control of a new undescribed wilt of tomato.

Investigation of virus diseases of stone fruits.

The bacteriophage and its relation to bacterial diseases of plants.

Microbiological investigations of silage.

The study and control of soil and seed-borne plant diseases.

Diseases of carnations (*Dianthus caryophyllus*). Their control and related cultural practices.

The pathology, physiology, and control of tomato anthracnose *Colletotrichum Phoimoides* (Sacc.) Chester.

Disease resistance in the tomato: A breeding project.

A study of fungicides for fruit disease control: Their toxicity diluents, and application.

Relative suitability of various copper-containing compounds for the control of vegetable diseases.

Development of disease resistant strains of cucumbers.

Development of leaf mold resistant tomato varieties adapted for glasshouse vegetable culture in Ohio.

Department of Dairy Industry

Pasture studies.

Factors in the processing, preservation, and utilization of meadow crop silages.

The carotene and vitamin A content of Ohio creamery butter as produced and following various periods of storage.

The relation of the thyroid mechanism to milk secretion.

Factors affecting the carotene, vitamin A, ascorbic acid, riboflavin, and thiamin content of the colostrum of dairy cows.

The effect of pasteurization and seasonal and environmental factors on the nutritive value of milk.

Factors affecting the quality of semen produced by bulls and the fecundity of spermatozoa kept in storage.
Calcium and phosphorus levels in the diet as related to reproduction and bone and tooth ash.
The analysis of data accumulated from the Ohio Experiment Station dairy herd over a period of 40 years.
Morphological and nutrient partition of hybrid and open-pollinated corn.
Raising dairy heifers on roughage.
Simple versus complex grain mixtures for dairy cattle.
Nutritional aspects of milk fever.
The curing of partially field-cured hay in the mow by means of forced natural air ventilation.
The physiological effect of extending the colostrum feeding period of dairy calves.
The effect of chlorobutanol treatment on the conception rate of "hard to settle" dairy cows and heifers.
The effect of ultra violet irradiation on the vitamin content of evaporated milk.
Systems of raising calves for veal and for herd replacements.
The effect of manipulation of the udder on the let-down of milk.

Department of Entomology

White grubs in relation to pastures and cereal crops.
The insect phases of the corn research program.
Codling moth control.
Codling moth ecology.
European red mite control.
Comstock's mealybug.
Apple aphid control.
Red spider control on vegetable crops and ornamental plantings.
Peach tree borer (improvements in control).
Tomato pinworm.
Improvements in control of plum curculio as a pest of peach.
Strawberry insects (improvements in control).
Evaluating insect resistance in varieties and strains of potatoes.
Evaluating insect resistance in varieties and strains of onions.
Chemical control of potato insects.
Chemical control of the onion thrips.
Chemical control of tomato insects.
Parasitization of oriental fruit moth.
Control of the oriental fruit moth.
Biological and chemical control of the Japanese beetle.

Department of Forestry

Preservative treatment of fence posts.
Post preservative test.
Marketing of forest products in six east-central Ohio counties.

The factors which influence the returns from maple sugar products in Ohio.
Nut tree investigations.
Sustained yield management of experimental forests.

Department of Home Economics

Effect of crushed ice refrigeration on conservation of vitamin C and on retention of weight of Ohio-grown vegetables.
The conservation of vitamin C in tomatoes.
Factors related to the serviceability of part-Aralac fabrics as compared to all-wool and all-rayon fabrics.
Minimum standards for clothing construction.

Department of Horticulture

Cause and adjustment of irregular fruit setting.
The role of auxin in horticultural plants.
Effect of growth-promoting chemicals on fruit set and yield.
Testing suitability of varieties of fruits and vegetables for freezing.
Orchard management studies.
Orchard fertilization studies.
Harvest sprays.
The causes and control of scalds, off-flavors, and shriveling of apples while in storage.
Dwarfing understocks for apples.
Apple variety trials.
Training and pruning of apple trees.
Apple breeding.
Caustic sprays for thinning apple blossoms.
Peach orchard soil management.
Black raspberry culture, fertilization, and irrigation.
Grape soil management and pruning studies.
Test of pear varieties.
Stone and small fruit variety trials.
Soil and cultural treatments for blueberries.
Culture of cherries and plums.
Peach tree training and pruning.
Effect of soil structure and oxygen supply on the growth of potatoes.
Evaluating insect resistance in varieties and strains of potatoes.
Fertilizers for potatoes.
Potato irrigation tests.
Relation of soil fertility and moisture to minerals in tomato fruits.
Culture of tomatoes grown for canning.
Factors affecting tomato cracking.
Carotene and vitamin C content of vegetables.
The storage of vegetables.
Fertilizers for early vegetable crops on sandy loam.
Muskmelon breeding.

Crop rotations and fertilizers.
Variety tests of edible soybeans.
Mushroom culture.
Breeding greenhouse vegetables.
Diseases of carnations.
The culture of carnations.
Flower bud differentiation and development in the azalea.
The effect of cooling treatments on early flowering of azaleas.
Rose culture and propagation.
Effect of preheated water on soil temperatures for growth of roses and other crops.
Earthworms: biology, culture, and influence on plant growth and on soil structure of commercial earthworm cultures.
Study of species, varieties, and clons of woody ornamental plants.
Value of certain tree paints as wound dressings.
Studies in propagation of ornamental plants.
The culture of orchids.
Flower bud differentiation and abscission in gardenias.
Variety tests on flowers.
Effect of time of pinching and duration of light on placement of flowers on chrysanthemums.
Flower bud differentiation of the hydrangea.
Argols and other sediment in grape products.
Processed food.
Frozen, pureed, and candied grape products.

Department of Rural Economics and Rural Sociology

Marketing Ohio livestock.
Wastes in the distribution of fruits and vegetables in Ohio.
Milk marketing under federal orders in Ohio.
Marketing forest products in east central Ohio.
The place of the small and medium sized slaughtering plant in the marketing of Ohio livestock.
The frozen food locker and home unit locker.
Desirable post war adjustments for Ohio agriculture.
Changes in Ohio farm land values.
The succession of son after father in farm operation.
Methods of renting land in Ohio.
Factors which influence the return from maple sugar production in Ohio.
The income of Ohio farmers by counties.
The trend in size of farms in Ohio.
Farm taxation and local government in Ohio.
Health status and needs of rural people in relation to services and facilities.

Financial Statement

July 1, 1945 to June 30, 1946

Consolidated Statement

ASSETS AND LIABILITIES

ASSETS

Current Assets	$ 172,461.05	
Contingent Assets	2,423,160.44	
Land	862,140.29	
Land Improvements	70,222.29	
Buildings	695,302.09	
Departmental Equipment	903,856.14	
Total Assets		$5,127,142.30

LIABILITIES

Capital Account	$2,703,981.86	
Special State Appropriations	2,423,160.44	
Total Liabilities		$5,127,142.30

INCOME AND EXPENDITURES

INCOME

Cash Balance July 1, 1945	$ 228,594.84	
Appropriations by State Legislature	795,919.00	
Appropriations from U. S. Government	196,490.35	
Sale of Produce, etc.	257,928.51	
Total Income		$1,478,932.70
Less Funds paid to State Treasurer and not available for Experiment Station		21.96
Total available Income		$1,478,910.74

EXPENDITURES

Salaries	$ 484,204.95	
Employees and extra labor	366,611.55	
Stationery and office supplies	5,504.28	
Incidentals	13,301.33	
Laboratory supplies	10,372.89	
Materials and general supplies	103,406.02	
Repairs to equipment	18,581.90	
Telephone and telegraph	4,917.31	
Freight, express, and cartage	4,578.89	
Travel	19,909.26	
Feed	93,420.57	
Fertilizers	3,257.54	
Apparatus	12,092.90	
Furniture and fixtures	4,603.94	
Machinery, tools, etc.	10,410.43	
Library	2,580.26	
Livestock	24,493.38	
Land	104,824.22	
Land improvements		
Buildings	19,378.07	
Total Expenditures		$1,306,449.69
By balance forward		172,461.05
Total		$1,478,910.74

Respectfully submitted,
W. H. Kramer, Bursar

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(For year ended June 30, 1946)

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V. D. HONCHELL, *Assistant* (Logan)
EMERSON HOUF, B. A., *Assistant* (Athens)
TURE L. JOHNSON, B. S. F., *Asst.* (Burton)
P. T. LANNAN, B. S. F., *Asst.* (Columbus)
B. E. LEETE, M. F., *Associate* (Chillicothe)
KARL S. LINDEMAN, B. S. F., *Assistant* (Columbus)
RICHARD LINDL, B. S. F., *Assistant* (Bowling Green)
G. C. MARTIN, *Assistant* (Marietta)
K. B. MCCLINTICK, M. F., *Asst.* (Defiance)
J. E. MCLAUGHLIN, C. E., *Asst.* (Chillicothe)
M. J. METTLE, C. E., *Assistant* (Chillicothe)
E. W. MILES, B. S. F., *Assistant* (Pomeroy)
W. N. MOULTON, B. S. F., *Asst.* (Chillicothe)
J. F. NEEDHAM, B. S. F., *Asst.* (Chillicothe)
G. T. O'MALLEY, B. S., *Assistant* (Chillicothe)
ROBERT R. PATON, M. F., *Associate*
ROBERT REDETT, B. S. F., *Assistant* (Lisbon)
ELBERT SCHORY, B. S. F., *Assistant* (New Philadelphia)
W. O. SCHRAMM, B. S. F., *Assistant*
J. D. WELLS, *Assistant* (Chillicothe)
ROBERT WHEATON, *Assistant* (Chillicothe)

HOME ECONOMICS (Columbus)

GLADYS BRANEGAN, Ph. D., *Chief*
EVA DONELSON, Ph. D., *Associate*
MARY BROWN PATTON, M. S., *Associate*
FLORENCE PETZEL, M. A., *Assistant*

RURAL ECONOMICS AND RURAL SOCIOLOGY (Columbus)

J. I. FALCONER, Ph. D., *Chief*
R. H. BAKER, M. S., *Assistant*
C. W. HAUCK, Ph. D., *Associate*
R. C. HEADINGTON, M. S., *Assistant*
G. F. HENNING, Ph. D., *Associate*
A. R. MANGUS, Ph. D., *Associate*
C. G. MCBRIDE, Ph. D., *Associate*
ROBERT MCCORT, B. S., *Assistant*
H. R. MOORE, M. S., *Associate*
R. W. SHERMAN, M. S., *Assistant*

DISTRICT AND COUNTY EXPERIMENT FARMS

M. A. BACHTELL, B. S., *Supervisor*

Superintendent	*Farm*	*Location*
HENRY MCMAHON	Belmont Co. Exp. Farm	St. Clairsville
HOWARD S. ELLIOTT	Clermont Co. Exp. Farm	Batavia
CECIL W. FRYMAN	Hamilton Co. Exp. Farm	Mt. Healthy
H. W. ROGERS, B. S.	Madison Co. Exp. Farm	London
L. W. SHERMAN, M. S.	Mahoning Co. Exp. Farm	Canfield
PERLE A. JONES	Miami Co. Exp. Farm	Troy
RANDO C. BEATTY	Paulding Co. Exp. Farm	Paulding
WALTER LIVEZEY	Trumbull Co. Exp. Farm	Cortland
RAY HOPKINS	Washington Co. Exp. Farm	Fleming
SERGE HARMON	Northwestern Exp. Farm	Holgate
L. S. POWELSON	Southeastern Exp. Farm	Carpenter
HARVEY L. WACHTER	Southwestern Exp. Farm	Germantown
HARRY OBENOUR	Muck Crops Exp. Farm	McGuffey
O. N. RILEY	Washington Co. Truck Exp. Farm	Marietta
H. L. BORST, Ph. D.[1] (Project Supervisor)	Soil Conservation Exp. Farm	Zanesville

[1]In Cooperation with the U. S. Department of Agriculture.
[2]Resigned April 30, 1946.

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